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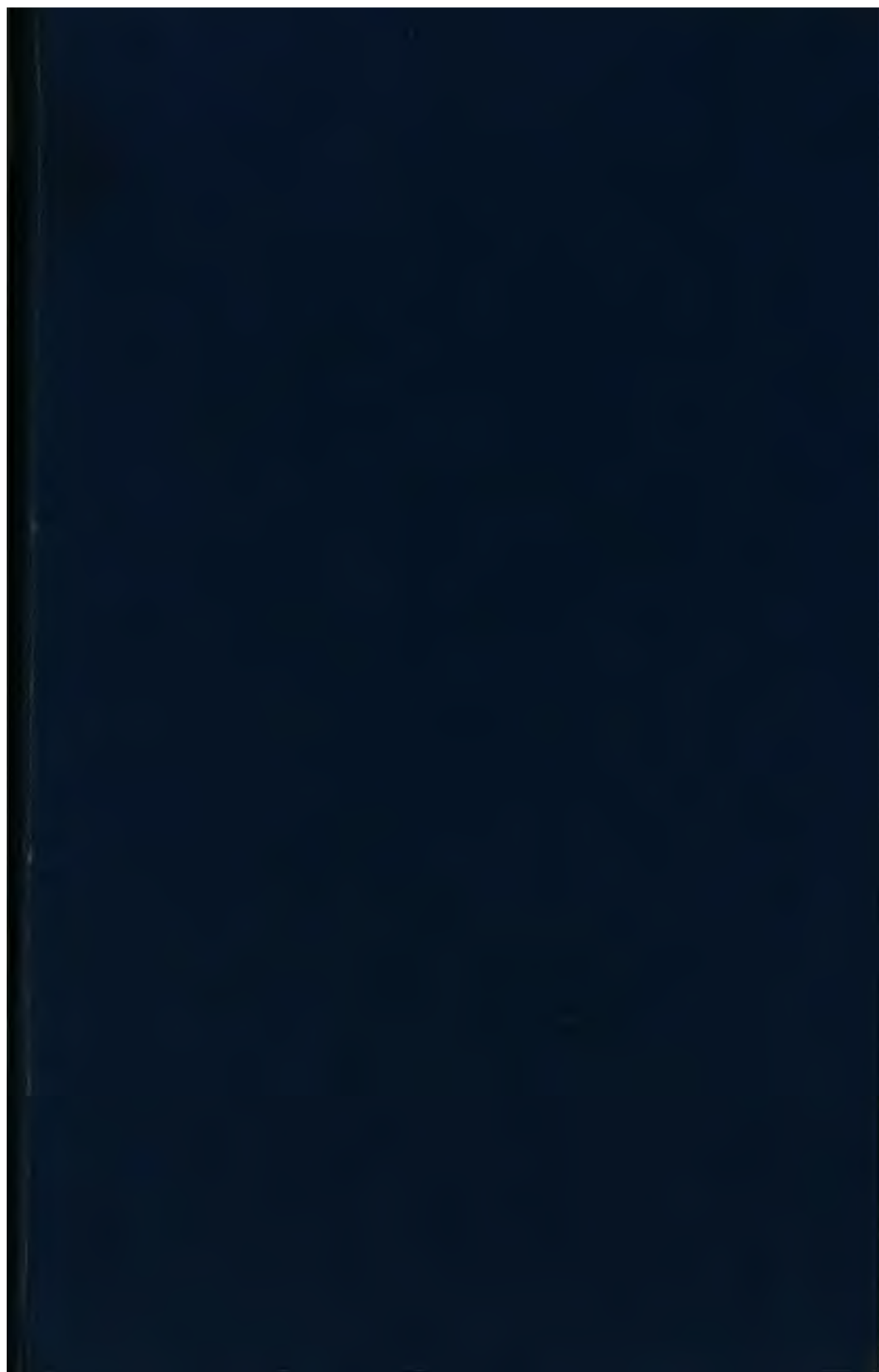
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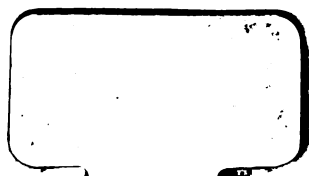
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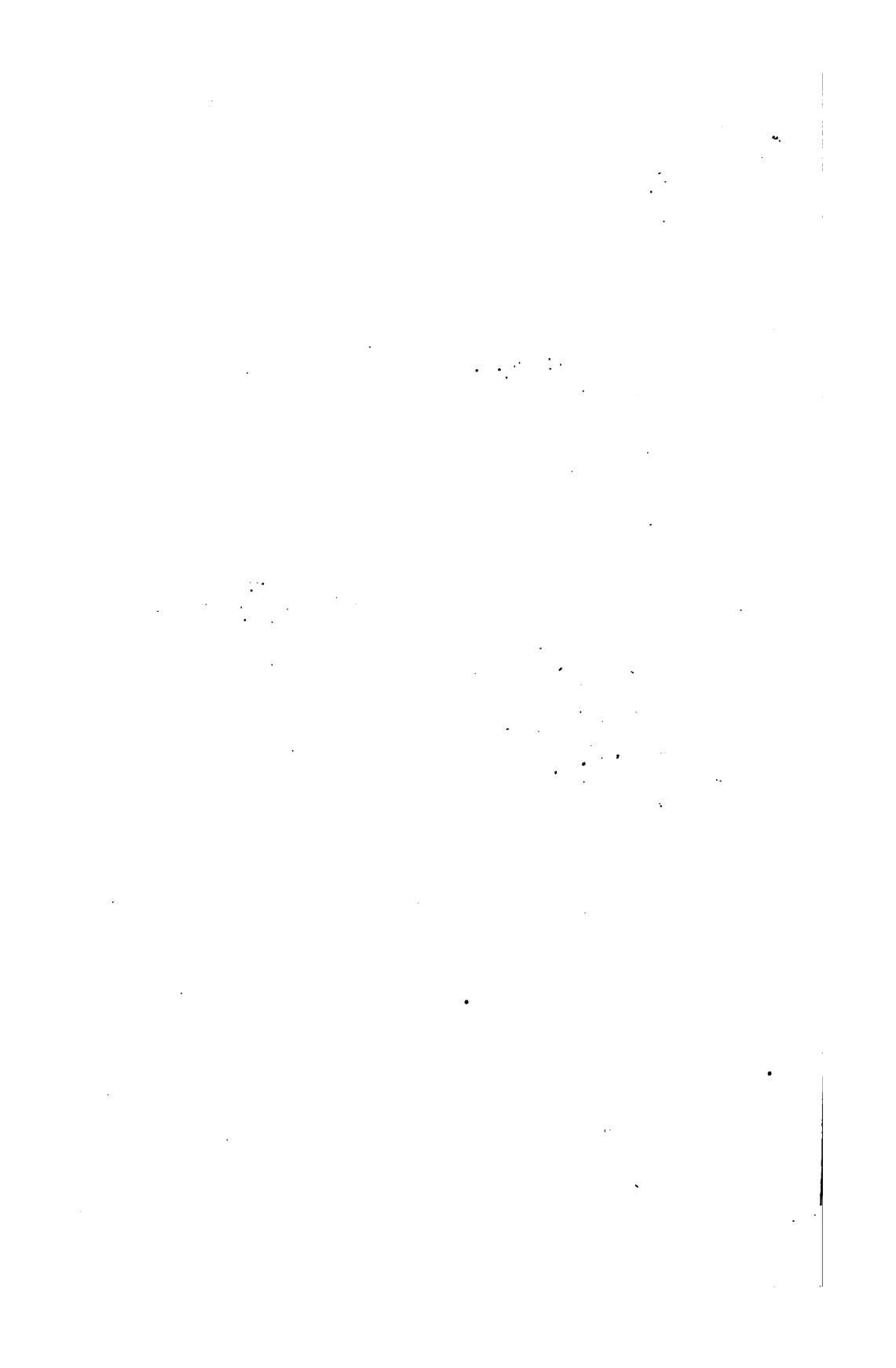




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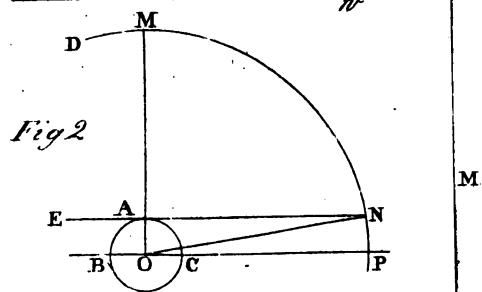
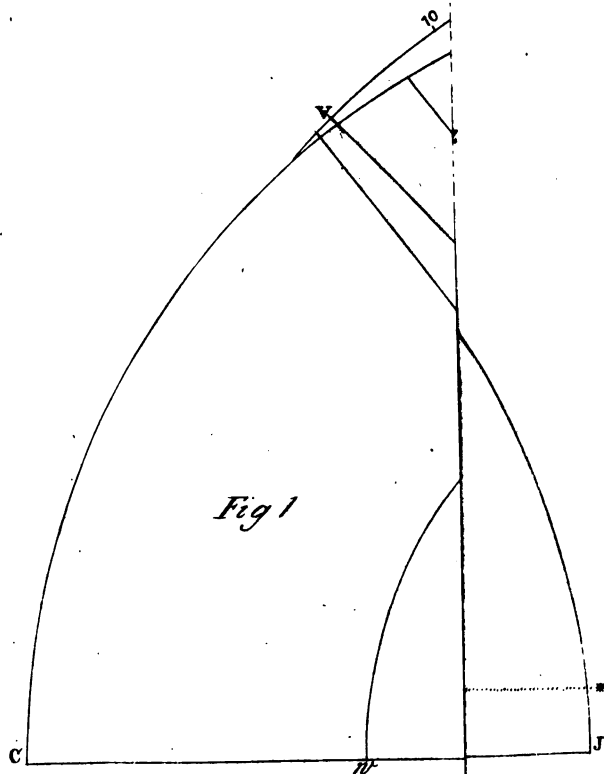












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A  
DEFENCE  
OF THE  
*DIVINE SYSTEM,*  
OF THE  
WORLD;  
WHICH REPRESENTS THE EARTH AS BEING AT REST,  
AND THE  
*HEAVENLY BODIES IN MOTION ABOUT IT:*  
WITH A  
DEMONSTRATION  
OF THE FALLACY OF THE  
*SOLAR SYSTEM,*  
INVENTED BY PYTHAGORAS, REVIVED BY COPERNICUS, AND  
ESTABLISHED BY SIR ISAAC NEWTON.  
TO WHICH IS ADDED,  
A REPLY TO AN ANONYMOUS CRITIC.

BY BARTHOLOMEW PRESCOT,  
OF ETRURIA, NEAR NEWCASTLE UNDER LINE.

God hath given me certain knowledge of the things that are, namely, to know how the world  
was made, and the operation of the elements: the beginning, ending, and midst of  
the times: the alterations of the turning of the sun, and the change of  
seasons: the circuits of years, and the position of stars.

WISDOM OF SOLOMON, CHAP. vii.

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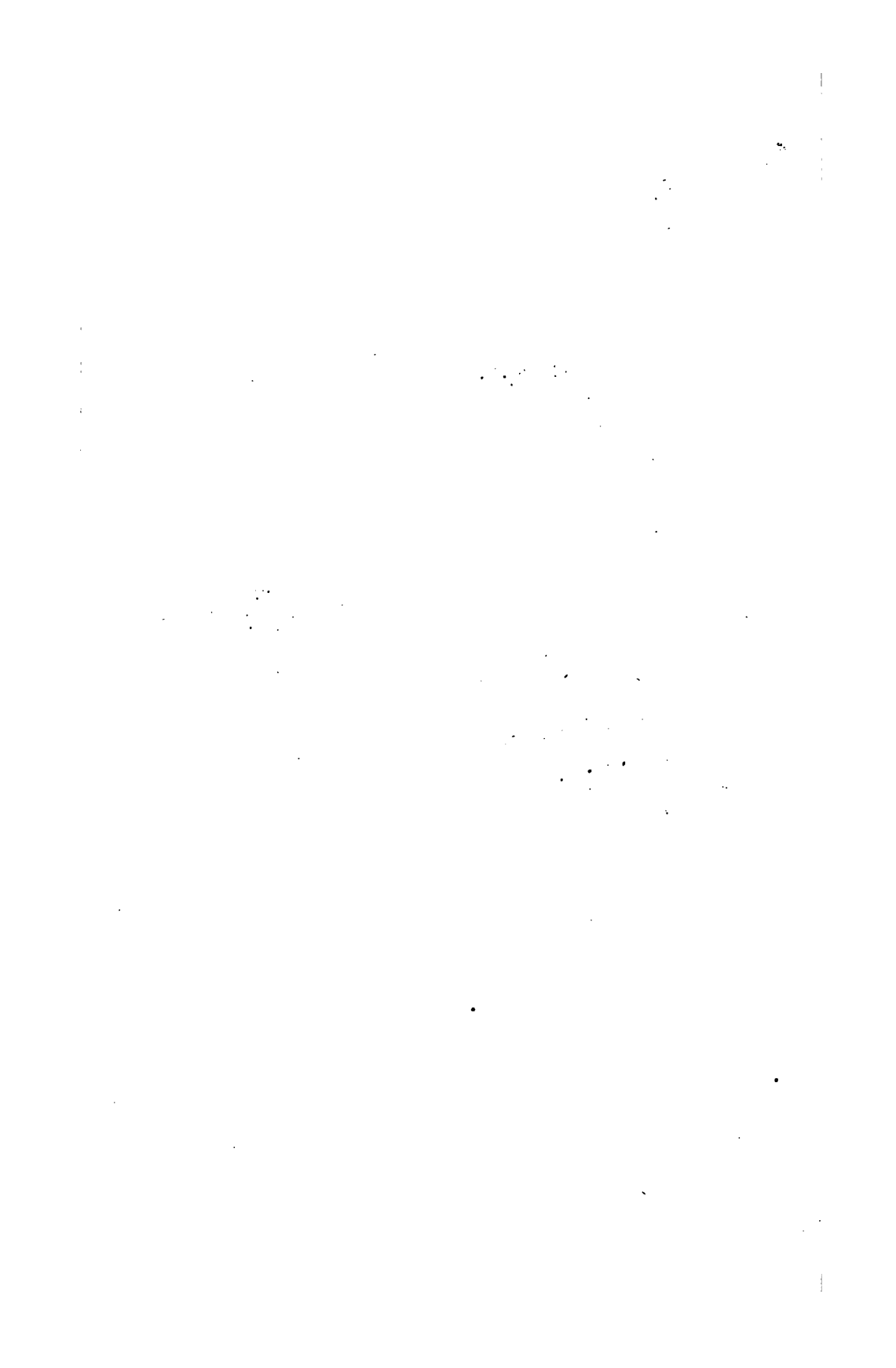
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gious are divided into many sects, and he who does not trim his conduct and principles according to the tenets of some one of them at least, stands but little chance of being attended to by any. DIVINE TRUTH and WISDOM met with a lamentable reception amongst the *learned and religious* Jews. The learned, so called, I therefore presume, are not the most friendly to the reception and spread of those sciences which have firm and incorruptible truth for their foundation.

Was it not under the meridian sun of learning in Greece, that the transcendent virtues of Socrates were hidden by a cloud of calumny and prejudice? Yes, it was in the presence of an assembly of enlightened Athenians, before whom he had not only proved his innocence, but also that he was a benefactor to the human race; in such a place it was, that the sage, in all the majesty of virtue, addressed his accusers, and those judges who condemned him, in words to this effect, "I am now going to suffer death by your condemnation, and they to undergo disgrace and infamy, by the condemnation and judgment of truth." O indelible stain upon Greece!

It was at a period when the learning of the Augustan age was spread over the civilized world, that the GLORIOUS FOUNDER of the christian faith and his immediate followers, appeared in various parts of the Roman empire. It is not necessary for me to enter into the particulars of their treatment—they were swept from the face of the earth as filth. Succeeding ages have, however, thought proper to dedicate churches to their memory, as the Jews built the tombs of the prophets they had murdered. It is not needful to swell my observations on this head, with parallel examples of modern date.

When I thus take a retrospective view of the memorable instances of the persecution of truth in former ages—in periods the most polished and enlightened by the arts and sciences; I think I may safely infer, without adverting to the temper of our own times, that public report, or public opinion, is no criterion to form a true estimation of those characters who are, from time to time, raised up by Providence, for the purpose of enlightening and preserving the world. Why, therefore, should I be deterred from the performance of my duty by the mistaken and unjust imputations fixed upon the illustrious character whom I have occasionally attempted to vindicate? I know that men who are sold to interest, temporary fame, or infatuated by the idols of human contrivance, rendered sacred by imposing names, are for a while permitted, by their false colourings, to disfigure the native beauty and divine simplicity of real truth and solid science; but it is, perhaps, that they may afterwards shine forth with a more captivating lustre, demonstrative of the majestic beauty of their immortal origin.

I have shewn in the following pages that the motion which the Newtonians have asserted the earth to have; the distances they have assigned to the heavenly bodies; their magnitudes; planetary attraction—never have, nor ever can be proved.

The system of the world which I have attempted to support, is that which was received, believed in, and taught by the most cele-

brated sages and astronomers of antiquity ; (I mean as far as respects the earth being at rest, however they might differ upon other subordinate points ;) and it is a system, not only consonant to the eye-sight, and to reason, but also quite reconcileable to all the appearances in the heavens, and convenient for all the useful purposes of calculation. It teaches, that the earth is at rest, having the sun, moon and stars, constantly revolving about it, for use and for ornament, at moderate distances, and of moderate magnitudes ; that, the planets partake of the general motion of the heavens as we see, but have also comparatively slow motions in oblique courses, or orbits peculiar to each ; that, Mercury and Venus are not so distant from the earth as the sun is,—in performing their courses they are never seen in opposition to the sun ; but, in declining north and south, they are sometimes seen to interpose between the earth and the sun. Such is the outline of the system I have adopted ; and, as astronomy will always be a useful study, I may hereafter be more particular,—if, in the order of providence, I should be favored with sufficient time and suitable convenience : at present my time is necessarily otherwise occupied.

Before I take my leave of the reader, it perhaps may not be foreign to the subject, upon which I have been treating, to offer a few remarks upon certain observations lately presented to the Royal Society, by a celebrated astronomer, concerning the planets *Ceres* and *Pallas*, lately discovered. I am of opinion, that the philosopher I allude to, does not by any means, consider the discovery as creditable to the solar system, but rather as making an inroad upon the boasted harmony of it : at any rate, he seems unwilling to allow them to be ranked amongst the Pythagorean worlds. To all appearance they have all things in common with the rest, and the only degrading circumstance is their diminutive size ; but why should that doom them to be thrust out from the rank of planets, and also to be stigmatized by the epithet “*ASTEROID* ?” Since the astronomers admit that they perform their revolutions round the sun, the smallness of their appearance can be no solid objection.

It is, notwithstanding, a serious charge against the pretended harmony of the solar system, that primary planets should be discovered belonging to it, whose magnitudes, if repeated five thousand times, would scarcely equal that of our moon, (according to the astronomers.) or, if repeated three hundred thousand times, would barely equal the bulk of the earth. The moon, which the Newtonians term a secondary planet, or a mere satellite, five thousand times larger than one of these primaries ! I should not at all be surprised if, (in order to prevent them from bearing witness to the inconsistency of the system, and at the same time to dispose of them to advantage, they were to assert, that such pigmy worlds are mere *make-weights* to balance the disorders which are said to distract the *machine* of the universe, by the *adventitious* effects of planetary attraction.

The astronomer I have just alluded to, gives the following definition of the new planets ; it is so remarkable, that it cannot fail to



strike the attention of the man of plain sense, as well as that of the philosopher. "*Asteroids*" says he "are celestial bodies which move in orbits, either of *little* or of *considerable* excentricity round the sun, the plane of which *may be inclined* to the ecliptic in *any angle whatsoever*. Their motion *may be direct or retrograde*; and they *may, or may not*, have considerable atmospheres, very small comas, disks or nuclei." This speculator is determined to allow himself room enough to turn about in; he concludes his observations by remarking, that "many extensive views relating to the solar system *might be hinted at*;" yes, "views" not at all creditable to that system. He says "their motion *may be direct or retrograde*." I would observe, that no other motion would at all be suitable to the solar system. By this observation, however, I would not have it inferred, that I consider the *direct retrograde*, or *stationary* appearances of planets, any proof of a motion of the earth, because these I believe, have a direct reference or application to the motion of the sun, and I will give my reasons for this belief, confining myself to real appearances.

In whatever part of his course the sun is, the stationary appearances of the same planet are, in all cases at the same angular distance from him, (with the exception of those trifling apparent irregularities, which the Newtonians attribute to the supposed action of the sun and planets upon each other, and the elliptical form of their orbits, but which small differences I attribute to the variable situations of the sun and planets, with respect to the station of the observer upon the surface of the earth;) the truth of this, though I have not seen it noticed in any work I have read, is evident from the following statement of the geocentric places, so called, of Saturn, Jupiter, and Mars, *when stationary* in the years 1797, 1802, and 1803, compared with the sun's place on the days mentioned. I have no ephemerides by me, excepting for those years, but I presume the like appearances in other years will be found to agree with those here set down.

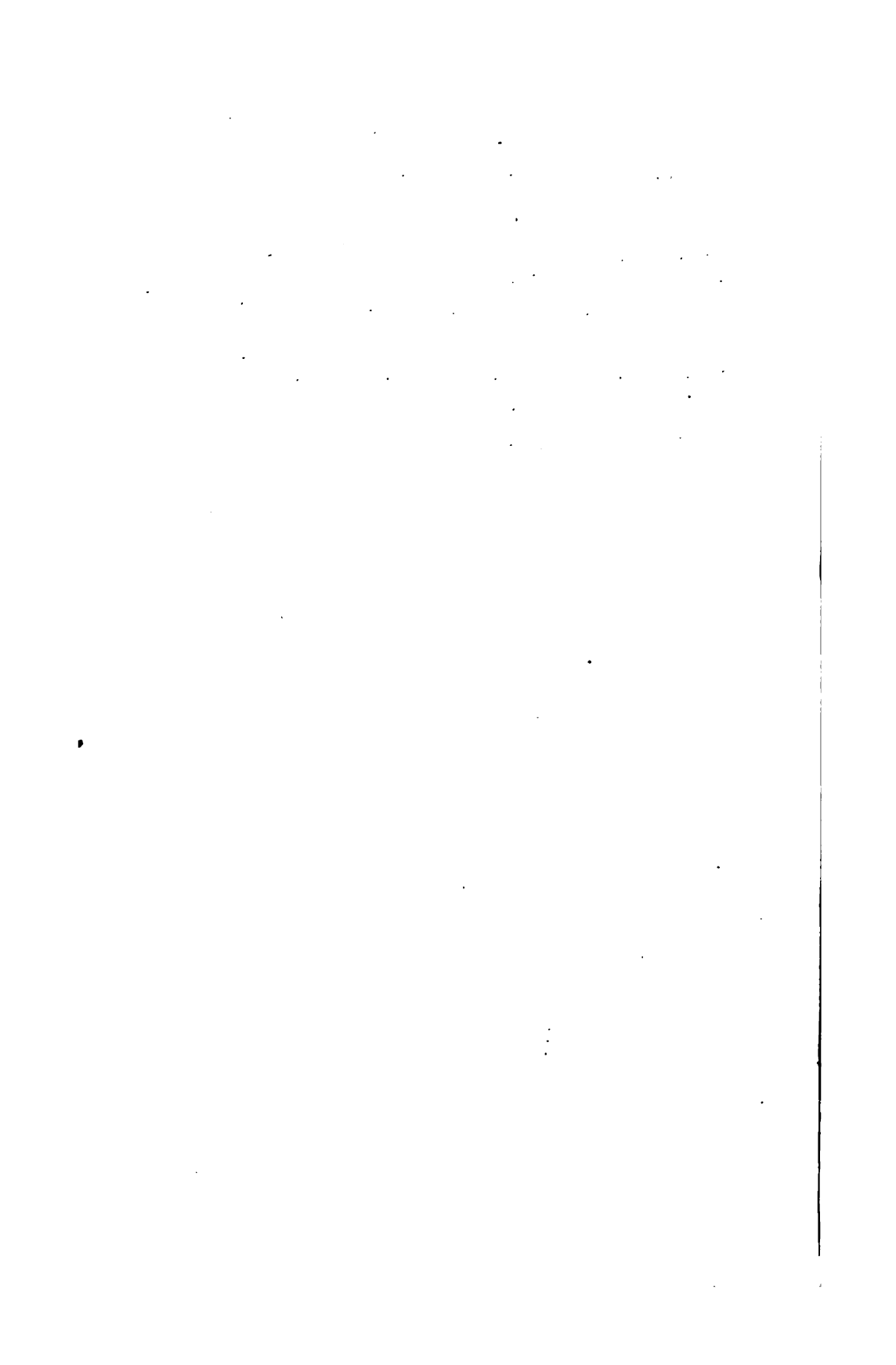
SATURN.			SUN.	DISTANCE.
1797, February 20.	in Gemini 20° 52'.	Pisces 2° 25'	—	108° 27'
October 23.	— Cancer 12° 2'.	Scorpio — 34'	—	108° 32'
1802, May 3.	— Virgo — 37'.	Taurus 11° 19'	—	109° 18'
December 31.	— Virgo 20° 41'.	Capricorn. 9° 11'	—	108° 30'
1803, May 16.	— Virgo 13° 51'.	Taurus 24° 36'	—	109° 15'

JUPITER.				
1797, August 8.	— Aries 19° 56'.	Leo 15° 20'	—	115° 24'
December 4.	— Aries 9° 59'.	Sagitar. 13° 55'	—	116° 1'
1802, April 22.	— Leo 25° 49'.	Taurus 1° 37'	—	114° 12'
1803, January 21.	— Libra 5° 58'.	Aquarius — 35'	—	114° 37'
May 23	— Virgo 26° 1'.	Gemini 1° 21'	—	114° 40'

MARS.				
1802, Novemb. 15.	— Cancer 12° 20'.	Scorpio 22° 26'	—	129° 56'
1803, January 31.	— Gemini 13° 58'.	Aquarius 10° 44'	—	133° 14'

The same is true of Venus and Mercury; from all which it is evident, that it is not necessary to refer to the imaginary system of gravity and attraction for proof of the uniformity of the immutable laws by which the planetary courses are governed: nor is there any occasion to subject the system of the world to any *ideal* laws of motion, or to bring it down to a standard of mechanical principles of human invention, in order to account for the planetary motions, or to delineate their paths; the latter may be done from their appearances, but the direction of the former can only, with truth, be referred to the immortal energy of that word which in the beginning, called them into being, and gave to them their several appointments.

*Etruria, 23rd May, 1803.*



## DEFENCE, &c.

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**H**ITHERTO I have been led to consider Mr. Brothers in his prophetic character as one being raised up by the Almighty, in the fulness of time, to hold up to mankind the mirror of truth; to invite them to a serious contemplation of it; to recommend an obedience to its peaceable precepts; and to warn them of the consequences of a refusal. I have endeavoured to hold him forth as one eminently designated for the important office—invested, according to the metaphorical language of scripture, with the key of David, to open and familiarly exhibit to human view the true meaning of those passages of scripture, concerning the mutations of kingdoms, which have, until his time, notwithstanding all the labours of the learned, been utterly inexplicable. This testimony I still hold.

In the above character I have been impelled to testify of him in three separate publications. On the present occasion I am induced to notice his mission, according to the view I have of it, as being intended to revive, and restore to the human race, true science, preparatory to that glorious age, of which, according to the sublime and elegant prophet Isaiah, "WISDOM and KNOWLEDGE shall be the stability of it."—"The Gentiles shall come to its LIGHT, and kings to the BRIGHTNESS of its RISING." When the nations, says Jeremiah, shall confess, "surely our fathers have inherited *lies*, vanity and *unprofitable things*."

His late publication, when candidly and attentively perused, must doubtless be allowed to have restored the true knowledge of several particulars in natural history, astronomy, architecture, antiquities, and other matters, which had been lost to the world by a long lapse

of dark and barbarous ages. It is indeed no less consistent with reason, than it is agreeable to what is recorded in the divine writings, that the glorious restoration, and subsequent prosperity of the Jews, should be particularly distinguished by a restoration of the true knowledge of God and his works. The foundation and superstructure of that kingdom, so magnificently described by most of the ancient prophets, will most certainly be strengthened and ornamented with every gift that can exalt and dignify its inhabitants. The nation which, while living in obedience to its divine lawgiver, enjoyed a splendid prosperity that was the envy and astonishment of the surrounding nations; and which, by disobedience and its woeful consequences, has still more astonished the world in the sum of its misfortunes, will, as sure as God is true, be once more raised to universal honour and admiration, and be the rejoicing and praise of the whole earth. For it is expressly declared "I will restore thy judges as at the first, and thy counsellors as at the beginning, afterwards thou shalt be called the city of righteousness, the faithful city. And the Gentiles shall see thy righteousness and all kings thy GLORY. Rejoice ye with Jerusalem, and be glad with her all ye that love her; rejoice for joy with her all ye that mourn for her; that ye may suck and be satisfied with the breasts of her consolations; that ye may milk out and be delighted with the abundance of her glory." These and other passages sufficiently intimate, that the return and establishment of the Hebrews will be adorned with every thing excellent and comely. That they shall not seek knowledge from those who hold them captive, but that they shall all "be taught of the Lord," who will freely invest them with all that can be necessary for real use and becoming ornament\*.

That the Hebrew nation is about to "arise and shine," is sufficiently manifest to me from an attentive perusal of the luminous composition I have just alluded to, entitled, "A description of Jerusalem, &c." Besides many important particulars which it is not

\* If it be asked, why I concern myself so much about the restoration of the Hebrews, I answer; every one who now believes, and feels an interest in their restoration, whether Christian or Jew, is an Hebrew: and not only an Hebrew, but also a real friend to the peace, prosperity and glory of the world. This will probably be made manifest to the world in a shorter time than people in general are aware of.

my present design to treat upon, his admirable exposure of the fallacy of the Pythagorean system of astronomy, revived by Copernicus, and established by Sir Isaac Newton's principles of attraction and gravity, I think is most eminently entitled to the notice of every lover of truth; as I look upon it exactly in the light of his own description; he says, page 104, "I subjoin my performance as a valuable present of instruction to enlighten the world.—It is an additional testimony to the *sure veracity of divine writ*, and will serve to put mankind on their guard against the idle speculative opinions of curious enquiring men, who by their talents for literature, and rank in life to give consequence to it; assume a privilege of subverting divine authority to establish their own, in a way entirely repugnant to the course of nature, plain evidence and fact."

A familiar writer on the science of astronomy, and a true convert to the Newtonian philosophy, exultingly says, "Newton has dissolved the chaos and separated the light from the darkness. His inimitable work, the Mathematical Principles of natural Philosophy, contains the true astronomical faith; and those who reject its doctrine are the *worst of heretics*, as they shut their eyes against the clearest of all light, demonstration." These are bold things to be said of a mortal man and his works; there are few, comparatively, in the present day, who will so ardently and so openly testify their admiration of Him, who is the sole author of all true science, and whose divine records have brought life and immortality to light. Whatever doubts may be entertained of the truth of the astronomical creed to which the author has subscribed, from whose book I have extracted the above passage, it seems certain that he is a bigot to it, and that he would freely excommunicate from the society of true believers in his tenets, all those who have courage openly to dissent from those astronomical principles which he seems to consider as infallibly true as if he knew them to be revealed from heaven. Knowing the imbecility of the human mind, unaided by divine instruction, in the pursuit of knowledge; and knowing also the fluctuation of opinion, for perhaps two or three thousand years past, upon this intricate science, it is truly amazing that most of the learned, since Newton's time, should have surrendered their understandings to the conclusions of his inventive genius, however emi-

ment in mathematical investigation he might be; especially when we find his supporters confessing that "the motions by which the operations of nature are performed, are not, for the most part, within the reach of our faculties; either by reason of the minuteness of the system of moving and mutually acting bodies, or the celerities of their motions. Our senses are bounded on either hand, by an immensity, of which an exceeding small part comes under their perception, &c." But, like all other human contrivances, this system, being new and curious, was of course destined to have its admirers; and being also more fraught with wonders than any other preceding scheme on the same subject, the number of its admirers has been correspondently great; as to the length of its duration, this has doubtless been owing to its being so strongly fortified with abstract principles, and puzzling intricacies; but more particularly I believe to the generality of mankind being unmindful whether the earth whirls round the sun, or the sun round the earth; fully satisfied that no new opinion upon the subject has the least effect upon its light, heat, and animating influence.

Since, however, the Almighty, in his goodness and wisdom, has thought proper to mention the creation of the heavenly bodies and their uses, as recorded in the first chapter of Genesis; and as this account is a part of the foundation upon which the book of truth is built, it certainly cannot be unworthy of a word said in its defence. The doctrine of a plurality of worlds has long been a most delightful theme for the sceptics, as being, in their opinion, a sufficient argument against the veracity of the bible records; and as they have conceived their belief to be founded upon a mathematical certainty, so their triumph has been most intemperate, but, unfortunately for their cause, after all their optical and mathematical researches, so far from being able to prove the existence of other worlds, such as the one we live upon, they have not been able to ascertain the magnitude or distance of any one of those bodies which they have so confidently concluded to be inhabited; so that for ought they know to the contrary, those stars which they have made to be several hundred thousand miles in diameter, may not be more than a few hundreds, and this I hope shortly to prove.

The empire of the Newtonian tenets of philosophy, seems at present to be as general and as absolute as ever popery was in the full zenith of its power; and, amongst the learned, so called, for any man to risk his reputation, by attempting to expose the rottenness of the system, would be esteemed an act of temerity no less dangerous to his reputation, than formerly it was hazardous to a man's existence, publicly to express doubts of the pope's infallibility. A few persons to whom I have expressed my conviction of the fallacy of the solar system, though in other respects they are characters remarkable for their candour, would by no means tolerate my objections to *that*; but when I came to speak of the hypothesis upon which it is supported, I generally discovered that they believed by faith in the fame of its founders, and not by conviction from an attentive examination of the subject; or they might soon have been convinced, that it has not known TRUTH for its BASIS, and therefore at least must be doubtful; and that as the *substructure* is *conjecture*, if that conjecture is proved to be false, no mathematical calculations, however plausible, can establish the *superstructure* as TRUE.

Although writers, in support of this system, have been sensible that it contains many errors, they seem generally to have been so tenacious of its honour, that they have wilfully forborn to exhibit them to public view; fearing, perhaps that the infallibility of its founders would be called in question, and the whole fabric thereby endangered. A late elegant writer upon the science of astronomy, observes, in his preface, "The attentive examination of other books to which the writer of this performance has had recourse, has shewn him, that even the works of those great men, who deserve and possess the highest reputation, are not free from *errors of importance*; the present occasion does not require the disagreeable task of pointing them out." From this kind of literary delicacy the empire of ignorance is continued, and mankind become more and more confirmed in error. It was most clearly the duty of a writer, of an introduction to natural philosophy, to point out the *important errors* of his predecessors, and thereby enable his readers to judge between truth and falsehood. But it is an instance in proof of that observation of Mr. Brothers, that, "The eminent philosophers



that have wrote since his (Newton's) time, however able to detect his errors, have not only omitted the meritorious duty, but have most culpably embraced his plan, and all his eccentric notions."

There can be no reasonable doubt that a knowledge of the system of astronomy called the Ptolomaic, or more properly the true divine system, which places the earth in the center, was handed down from the first progenitors of mankind. Mr. Brothers observes, "But say the advocates of the solar system, '*the scriptures were not given for explaining systems of natural philosophy, but for a much nobler purpose, to make us just, virtuous and humane*.' They are all in an error—the scripture contains the finest lessons with the easiest explanations of natural as well as moral philosophy; and it not only teaches a man to be *just, virtuous and humane*, but also according to their own definition of the term, it teaches him to be *wise*, by instructing him in the true knowledge of the heavenly bodies. Solomon, who had God himself for a preceptor, owns his perfect knowledge of the heavenly bodies, their continual circuit round the earth, and their entire use for it. King David, though he had not the divine advantage of his son, yet his knowledge of astronomy, as taught by the Hebrews in his time, is so just as to be mentioned in the Psalms, and of course approved of by God. Abraham understood it well and added many improvements to the Egyptian system. But surely, under every moral, natural and religious point of view, for a man to be '*humane, just and virtuous*,' is for him to be really wise, although he may not know any thing of the astronomical errors of Pythagoras or the great Sir Isaac Newton." I believe it does not appear that the world ever thought of any other system than that which places the earth in the center of the universe, until the appearance of Pythagoras; although it seems certain, that in most, if not all the other arts and sciences which serve and embellish society, they generally excelled the modern comparatively as much as the splendor of the sun exceeds the twinkling of the stars. As poets, orators, historians, sculptors and architects, the antients may pre-eminently claim the precedence in order of merit. In mathematics the moderns *kindly* class Archimedes next to Newton. Euclid and Archimedes though deservedly celebrated for a comprehensive acquaintance with mathematics, and

their application to all the useful purposes of life, could not, it is true, like modern astronomers, pretend to "gauge the heavens," nor weigh the burning sun and the other ponderous orbs that roll on high. They never discovered, at the amazing distance of ninety five millions of miles, that the sun had an atmosphere; nor could they observe the increase and diminution of snow about the poles of the planet Mars, at the distance of about fifty millions of miles. It was equally out of the scope of their calculations to demonstrate, that one hundred and ninety millions of miles, when compared with the distance of the fixed stars, was a mere imperceptible point! These sublime discoveries were left for the mighty expansion of modern intellect. As little could the ancients conceive it possible for a material body to be set in motion with a velocity equal to more than eighteen hundred times that of a cannon ball! namely, eight hundred and eighty thousand miles an hour, or two hundred and forty four miles in one single second of time! The discovery of these and many similar wonders, was reserved for the sagacity of modern philosophers. Of such materials the Newtonian creed is composed, and in these days, to be esteemed a rational scholar, it is necessary thus to believe! The optical principles were well known to the geometers two or three thousand years ago, as may be seen in Euclid; it is true they did not apply them to the discovery of new worlds; but confined them to useful purposes in the world in which we live. That the ancient geometers were acquainted with the mathematical principles of optics, may reasonably be admitted from what we are told of Archimedes: at the siege of Syracuse it is said he destroyed the ships of Marcellus by a machine composed of Speculums. Whether the ancients were equal to the moderns in their application of mathematics to their mechanical pursuits, may be left to the decision of those surprizing monuments of art still remaining to be seen in Egypt, Syria and other parts; while on the one hand travellers admire the beauties of proportion and transcendent excellence of the workmanship, they are on the other hand no less amazed at the astonishing powers which must have been used to move and rear particular parts of them.

Mathematics are only of importance as they are applied to serve  
 • ornament society; and he that so employs them most successfully,

is the greatest mathematician. It is as easy for men of playful speculative imaginations to pervert pure rational mathematics; to frame curious hypotheses; to build ingenious arguments upon them in order to display the subtilty of their wit, and, notwithstanding, to draw ridiculous conclusions, as it is to do the same things in Ethics or any other branches of philosophy. A speculative writer of the present time, read and admired by thousands, is of opinion that the infirmities of old age might be avoided if people were constantly to use the exercises of youth, and that even they might so continue active, and immortal! such perverse reveries as these, upon the plainest and most obvious concerns of life, are soon detected and exposed; but when men speculate upon theories far above the sphere of human action, and hedge them about with subtilties invented for the purpose, they have a better chance of enjoying a long and high-sounding fame; and that in proportion as their productions are difficult to be understood, especially if supported by a few visionary characters of like genius, and of rank is life to give credit to their pursuits. Whenever the time shall come, that mankind, content with the space allotted to them by their creator in this world, shall cease to speculate upon regions of unlimited space, far above human comprehension, and shall no longer employ their imaginations in creating suns and worlds without number, I believe Sir Isaac Newton's aerial mathematics—his fluxional calculus, for the most part, will be esteemed a spurious branch of this useful science, and consequently be exploded with the laws of motion they have been employed to support and establish.

I have just observed that although the ancients, at the time, and long before, the appearance of Pythagoras, were eminently distinguished for their superlative knowledge in most of the arts and sciences that could adorn society, they had never, it seems, thought of the fanciful system of the Universe which he promulgated, and prone as they were to listen to fabulous novelty, it does not appear, that they were much charmed with his extravagant hypothesis, for, immediately it is said on the appearance of those luminaries of the heathen world, Plato and his contemporaries, it was dismissed, and the ancient true system restored; nor could it ever after obtain but a momentary footing, until the time of Copernicus, by whom it was

revived. From his time the opinions of the learned fluctuated between the Solar, Ptolomaic, and Tychonic systems, until the genius of Newton laid hold of the subject; "he," (says Mr. Brothers) "in following the notions of Pythagoras and Copernicus, improved on their writings, and fully adopted their system as better suited to his fanciful, though strong and speculative genius, where he could range without any boundary of space to limit him; and where he could travel over inhabited worlds without end, or even fatigue of body to tire him, nothing of which he could possibly effect in the divine, it being too narrow, too plain, as well as too easily comprehended to serve for any purpose of fancy or fable. The Greek philosophers were perfect adepts in the knowledge and writing of mythological fables, and our English philosopher seems to have got his mind in some measure tainted with their stories; for his imagination, like theirs, led him to soar above this narrow world to explore unknown regions, and tell his credulous, but astonished fellow creatures, what wonders—what marvellous works he had discovered! that the objects they took for little stars at night were some mighty large suns, and others, inhabited worlds like our own. Not only his own countrymen now, but most Europeans, believe his astonishing tale as the perfection of study and truth."—"The whole is an imposition, but it is so shaped into a regularity of order, and so plausibly contrived for imposing on the senses by reconciling incredible distance, heat, and magnitude of bodies to mathematical rules, that considering the love of novelty in mankind, and the eminent character that wrote, a part of my surprise is done away; for few men like the trouble of examining the veracity of an account of worlds they had never visited, or of wonders they had never seen, especially when it comes from high authority. He knew, no doubt, that by speculating beyond the bounds of human knowledge, where fancy could freely indulge itself in the most extravagant ideas, and where nothing short of divine investigation could ever reach to detect the error and expose it, his philosophy would stand firm against all attacks in England, like the Koran in Arabia; for until such a time there could be no apprehension, but opinion would oppose opinion, and his rules of optics and mathematics would be sufficient to delude reason and repel evidence—then indeed his system,

though ably supported, must be thrown down, not by man, but by divine power from God himself."

Having made these preliminary observations, I now propose briefly to consider, how far the Newtonians have, upon solid grounds, established the fundamental principles of the solar system. And first I shall notice the arguments they adduce to prove the daily motion of the earth upon its axis. Knowing the establishment of this point to be absolutely necessary to the support of their system, they have not been sparing in their labours to produce whatever reasons could have the least colorable pretence to defend it. They are well aware that their system is not necessary for the more accurate calculation of eclipses or the more exact measurement of time. These matters have been ascertained by long observation of the apparent motions of the heavenly bodies, and were known before their system was thought of. Accordingly Mr. Pemberton says, "If the astronomer should suppose the earth to *stand still*, he could ascribe such motions to the celestial bodies, as should answer *all the appearances*; though he would not account for them in so *simple a manner* as by attributing motion to the earth. But the motion of the earth must of *necessity* be considered before the real *causes* which regulate the planetary system can be discovered." So then the earth must be set in motion before the *causes* of the planetary motions can be *discovered*! that is to say, before they can account for the complex motions of these wonders of creation, it is necessary to bring them down to a standard of human mechanism!

The first proof of the earth's motion I shall take notice of, is that which is deduced from the turnip shaped figure which the Newtonians attribute to it. Their endeavours to ascertain by experiment the truth of Newton's theory upon this point, are without doubt no less curious than they are refinedly minute.

It was found that clocks adjusted to true time at Paris, when brought nearer to the equator, became irregular and moved too slow. That it was particularly examined how much of the difference was owing to the extension of the rod of the pendulum by the heat of the sun in the torrid zone; and it was found that the rod of the pendu-

heat could not be lengthened by the increase of heat more than one  
 tenth of the quantity it was found necessary to shorten it, in order  
 that it might be brought to beat true time at the equator. And this  
 they attributed to the protuberant figure communicated to the earth  
 about the equator, by a motion on its axis, similar to what a soft  
 ball of clay would receive if a rod were thrust through it, and turned  
 briskly like a grind stone on its axis. That a ball of soft clay would  
 thus quickly become distorted—swell out in the middle and contract  
 at the poles—they without doubt had ascertained by experiment.  
 Reasoning by analogy,—how this would apply to the great globe on  
 which we live, composed of water, soft earth, loose sand, and solid  
 rocks, I leave common sense and their experiment to decide. Now  
 the whole effect of this motion they assert to be only seventeen or  
 eighteen miles at each pole; namely, that the polar diameter is about  
 thirty four miles shorter than the equatorial diameter, and therefore,  
 Paris would be about nine miles nearer to the center of the earth  
 than places about the equator. It seems, at the time this nice proof  
 of the motion of the earth was given, that from experiments made  
 by Picart and De la Hire on the effects of heat and cold in length-  
 ening and contracting iron rods, some doubts were raised whether  
 the rods of pendulums were not extended by the heat of the sun, in  
 the torrid zone, to *all that excess of length* the observers found them-  
 selves obliged to lessen them by. Here we find doubts were raised  
 against the result of an experiment which was made to establish  
 Newton's theory of the motion of the earth. But Newton said dif-  
 ferently and his fame had already become a vortex which easily swal-  
 lowed up petty objections without much examination. There is  
 however one effect upon pendulums, which these experimentalists do  
 not seem to have at all noticed, and which I am of opinion would  
 fully account for the difference they discovered, in a way somewhat  
 less preposterous than by referring it to a motion of the earth on the  
 equator more than twice the velocity of a cannon ball. No person  
 will deny that the air gradually becomes more and more dense in  
 removing from the equator towards the polar regions. Will the in-  
 creased density of the air have no effect in shortening the vibrations  
 of a pendulum? certainly it will, and consequently cause a clock to gain  
 time in proportion. But, when a man is building to himself a tower  
 of fame, he is not always very nice in examining objections to it.

The next proof adduced to establish the oblate figure attributed to the earth, is that taken from certain measurements made upon its surface. To determine this question the whole arc of the meridian passing through France was measured, by order of the French King: this was accomplished in the year 1718, by Picart, De la Hire, and Cassini. The latter it is said depending more upon the accuracy of his measures, than from conclusions drawn from Newton's theoretical reasoning, contended that the form of the earth was that of a prolate spheroid, flattened at the equator and protuberant at the poles; somewhat resembling the figure of an egg; while Newton, sitting in his chair, without measuring an inch, or taking a single observation, as strenuously contended, on the contrary, that its figure had a greater resemblance to a garden turnip, or an orange. The question was now considered of the greatest importance, as involving the honour of the two nations. Accordingly the French King (Louis the XIV.) in order to bring the matter to a determination, resolved to send philosophers to the north and south, to measure a degree of the meridian in both places. One company went to Bothnia in the north, and the other to Peru in the south. The latter, having measured above three degrees of the meridian, resolved that the first degree of the meridian from the equator was 56753 toises. The philosophers who went to Lapland, having measured somewhat less than a degree of the meridian cutting the polar circle, gave, as the result of their calculations, 57422 toises for the length of a degree, namely about a ninetieth part more than a degree at the equator was found to be. It is not necessary for me to go into a detail of the operations which produced these results; it may be sufficient to observe, that the length of the line measured by the astronomers in the south was about two hundred and twenty english miles; that they were about six years upon the expedition and had to encounter great difficulties: they had to clamber over immense mountains; to ford rivers; to take a multitude of angles on the surface on the earth, as well as to make observations on the heavenly bodies; besides measuring lines, &c. and when all these things were done, they had to reduce their measurements and observations to the level of the sea. When it is also brought into consideration, that all mathematical instruments are more or less inaccurate, and also liable to become more so, from change of heat and cold; add to all these

difficulties the refractions of the horizon, and the effect we are told the great mountains of Peru had upon the plumb line of one of their largest instruments, drawing it seven seconds from a true perpendicular; I say that when all these things are duly considered, surely no reasonable man acquainted with mathematical pursuits, will seriously stand up and say, that it was not possible they could make a mistake of one yard in ninety or (one hundred and eighty the medium,) the proportional difference: he would rather say if he spoke with candour, that it was not only possible but more than probable. Such however is the other *experimental proof* of the figure of our earth, and thence of its motion on its axis. Whatever objections serious men may now think it liable to, it was *then* readily received, and admitted, along with the pendulum, to give support to this favorite hypothesis, which, long before that time, had charmed and prepossessed nearly all the philosophers in Christendom. But what is rather curious, and certainly deserves to be noticed, is, that the measurements made in France, from which Cassini *mathematically demonstrated*, that the form of the earth was that of an *oblong spheroid*, were now brought forward to prove that the opposite figure, namely, the *oblong spheroid*: and they tell us that after "*proper corrections*" it agreed "*very well*" with the proofs of the other Philosophers. The truth of the matter is, the general current of opinion ran in favour of the Newtonian theory: there was neither credit nor chance of success to be had in resisting the stream; so that insulated objectors, though possessing superior knowledge, were soon silenced, and, undistinguished, obliged to move along with the crowd.\*

Now for the proof of the earth's revolution in an orbit round the sun. "That the sun, and not the earth" (say the Newtonians) "is the center of our solar system, may be demonstrated beyond a possibility of doubt, from considering the forces of gravitation and projection, by which all the celestial bodies are retained in their

\* Since writing the above I have seen the Monthly Review of December last, wherein mention is made of "an introduction to a memoir, by M. Swamberg, Secretary to the Academy of Sciences at Stockholm, lately sent by that learned body to retrace and examine the operations of the French Mathematicians who in 1736 measured a degree of the Meridian under the polar circle. The Swedish Astronomer has found, as has been repeatedly suspected that the angles of the stations were not correctly taken."



orbits." As a plain reader, unacquainted with this jargon, and who has always considered the creator as the efficient cause of all these wonderful movements, may possibly be astonished to hear, that *gravitation* and *projection* are the *causes*; I will endeavour to explain the matter; the same things are elsewhere expressed by the hard words *centripetal* and *centrifugal* forces; and they give us an idea of their meaning by supposing a ball, fastened to the end of a string, and whirled round the finger; the ball represents the earth or any planet, and the finger the sun; the motion of the finger the projectile, centrifugal force, or impulse which drives the planet onward, and the string the gravitation, attraction or centripetal force. "It is upon this foundation," says Mr. Pemberton, (the intimate friend of Sir Isaac Newton,) "that all his (Newton's) discoveries in the system of the world are raised." And he accordingly recommends it to the particular consideration of his readers. A pear, as we are informed, by striking Sir Isaac on the head in finding its nearest way from the tree to its natural parent earth, laid the foundation of his system of gravity and attraction. The idea of a *soft body* turned about like a grind-stone, induced him to assert the earth to be of a distorted figure; and the ball whirled round the finger illustrates the manner in which this globe, and all the works of man upon its surface, is whirled round the sun in an *elliptical course* (suitable enough to the *turnip shaped traveller*): at the wonderful rate of one hundred and forty one times the velocity of a cannon ball. Reader, if you are astonished at the rate the philosophers send you round the body which was created to give you light, you must surely be charmed with the great simplicity of these illustrations, hit upon to accommodate their grand conceptions to your circumscribed capacity! To proceed "For, if the sun moves about the earth, the earth's attractive power must draw the sun towards it from the line of projection, so as to bend its motion into a curve; but the sun being at least 227,000 times as heavy as the earth," (that is, about 550 times the bulk of all the worlds, which even the Newtonians suppose it to be intended to give light to!) "By being so much weightier as its quantity of matter is greater, it must move 227,000 times as slowly towards the earth as the earth does towards the sun, and consequently the earth would fall to the sun in a short time if it had not a strong projectile motion to carry it off. The

earth; therefore, as well as every other planet in the system, *must have a rectilineal impulse, to prevent its falling into the sun!*" If this be true, it behoves us to pray that the RECTILINEAL IMPULSE may continue for ever with unabated vigour, for, if it should, by any mechanical derangement, happen to cease, we are assured upon the authority of Newtonian philosophers, that the world and all its glories would immediately be swallowed up in the fiery billows of the flaming sun! Reader, will you believe this, or what was once said, with unadorned benignity, by the FOUNTAIN OF TRUTH, when he intimated that the most insignificant objects of creation could not fall, even to the earth, without the knowledge and permission of our heavenly Father? Again, "There is no such thing in nature as a heavy body moving round a light one as its centre of motion. A pebble fastened to a mill-stone by a string, may by an easy impulse be made to circulate round a mill-stone: but no impulse can make a mill-stone circulate round a *loose* pebble." And pray what kind of an impulse would carry a pebble round a *loose* mill-stone? surely it would be necessary to fasten the mill-stone itself to a center of motion before it could carry the pebble round with it. By such contemptible reasoning have mankind been duped into a belief of the infallibility of the Newtonian philosophy. Well did the learned apostle St. Paul caution the Colossians to beware lest any should spoil them through the deceptions of philosophy.

To proceed; "By considering the law of gravitation in another light, it will be evident that the earth moves round the sun in a year, and not the sun round the earth. It has been observed, that the power of gravity decreases as the square of the distance increases; *and from this,*" (now here is the grand characteristic of the Newtonian philosophy, as far as concerns the system of the world, namely, to infer *real* effects from *imaginary* causes; the laws of gravity have never been demonstrated to be true, nor can they; the descent of an apple or a pear to the ground is no proof of it; no experiment can be made to shew that the velocity of falling bodies *increases as the square of the distance*, the motion being too quick; as to any theoretical reasoning that may be applied to support the doctrine, it is at least uncertain. If heavy bodies were inclined to fly upward instead of finding the nearest way to the earth to

which they belong, and with which they were created, then indeed there would be some reason for writing about their attraction) "and from this it follows with mathematical certainty, that when two or more bodies move round another, as their centre of motion, the squares of their periodic times will be to one another in the same proportion as the cubes of their distances from the central body; this holds precisely with regard to the planets round the sun, and the satellites round the planets: the relative distances of all which are well known."

This curious doctrine which Sir Isaac Newton borrowed from Kepler, namely, to ascertain the distances of the planets from their periodic times, is the same as to estimate the length of a man's journey by the time taken up in the performance of it. And it is just as learned as that other rule which they apply to the fixed stars, by which they estimate their distances to be in proportion to their apparent magnitudes.

Again, "But if we suppose the sun to move round the earth, and compare its period with the moon's by the above rule, it will be found that the sun would take no less than 173,510 days to move round the earth; in which case our year would be four hundred and seventy five times as long as it now is." This might perhaps be admitted *according to their rule of reasoning*, but since I hope to shew, that they cannot measure the distance of the moon, leaving that of the sun out of the question, no regard ought to be paid to such reasoning. To proceed "To this we may add, that the aspects of increase and decrease of the planets, the times of their seeming to stand still, and to move direct and retrograde, answer precisely to the earth's motion;\* but not at all to the sun's, without introducing the most absurd and monstrous suppositions, which would destroy all harmony, order and simplicity, in the system." Meaning *in their*

\* Because they have adapted to it their theory of distances, namely, Kepler's mathematical theory. They have moved them to distances *corresponding* to their motions direct, retrograde, &c. but, after all, the real motions of the superior planets have in many instances been found to be inexplicable by their system, although so nicely fitted; as will be noticed in another place.

*own system*, for the real system of the heavens cannot be affected by any suppositions. Mercury and Venus accompany the sun and evidently partake of his motion round the earth, but most certainly they, and the rest of the heavenly bodies, have their own peculiar motions, originally communicated, and still continued by the eternal architect. These philosophers might, with as much reason, attempt to apply their mathematical laws of motion to explain the motions a human body receives from the spirit which animates it, as for them vainly to attempt to explain the causes of those astonishing motions of the heavens which could alone proceed from and be perpetuated by, the wisdom and energy of the spirit of the almighty creator. To make their system the more digestible, and especially the most extravagant parts of it, they occasionally introduce some warm effusions of natural religion; extolling the supreme being for creating the phantoms of their own imaginations; namely, an infinite plurality of suns and inhabited worlds. They do not indeed profess to know *how* this vast creation was accomplished by the supreme being; but the *causes* of the *motions* of these mighty works they pretend to have discovered in the resources of their own intellects; and anathematize from the community of rational beings all those who refuse to believe them. If the secret of creation is known only to the creator, it certainly follows, that a knowledge of its movements is equally beyond the reach of man. If men have vainly attempted for several hundred years to give a perpetual motion to machines of their own construction; it surely is childish, to say no worse of it, to make a pretension of having discovered the *causes* of those complex motions observed in the magnificent works of the Almighty. Because the ancient astronomers were too modest to make a boast of any such pretensions, the moderns brand them with the epithets of inexperience, ignorance and incapacity. On the contrary I consider it an eminent proof of their sound judgment and wisdom.

The aberration of light, supposed to have been discovered by Dr. Bradley, was, for some time, gladly received and embraced as an argument to prove an annual motion of the earth in an orbit, but this seems now to be exploded as quite insufficient to support the motion, since we are told that Mr. Maskelyne in attempting

to find the parallel of Sirius with a ten feet sector, observed; that by the friction of the plummet-line on the pin that suspended it, an error of ten, twenty and sometimes thirty degrees was committed. It is therefore most clearly evident that no regard ought to be paid to Dr. Bradley's observations on this point, since he professed to have found the apparent places of certain fixed stars to differ from their true places only about twenty degrees. An angle so small that in the very act of taking it he might have fallen into an error greater than the whole quantity.

Whilst I am writing this, I observe announced in the appendix to the monthly review, another supposed proof of the earth's distortion, and consequently of its motion; it is by a M. la Place, and not very dissimilar to the above; at any rate it is a *proof* no less refined, and I believe entitled to neither more nor less credit. It is said, "in the moon's orbit, there is a movement of nutation analogous to that of the terrestrial equator, and of which the period is that of the movement of the moon's nodes. The spheroid of the earth, by its attraction on that satellite, causes the lunar orbit to oscillate, in like manner as the attraction of the moon, or the spheroid of the earth, causes our equator to oscillate. The extent of this nutation depends on the oblateness of the earth, and thus may throw great light on that important element. There results thence, in the latitude of the moon, an inequality proportional to its mean longitude, and of which the coefficient is  $6''\frac{5}{8}$ , if the earth's oblateness be  $\frac{1}{334}$ ." Now observe, here is an inequality

given in the moon's latitude, so small as to be only about the  $\frac{1}{50000}$  part of  $90^\circ$ . I would seriously ask any person in the least conversant with the difficulty and uncertainty of taking very small angles, if he can be positively certain, that in observing luminous bodies in the heavens, he can depend upon an accuracy of one fifty thousandth part of the whole arc of a quadrant? I am fully convinced that this new support, offered to their system of motion, is as weak and inconclusive as that of the pendulum, measurement of meridians, and aberration of light, and will with these in due time, be despised by every rationally thinking man.

After all the arguments brought forward in support of the earth's motion, Mr. Nicholson in his introduction to natural philosophy, seems so satisfied of their insufficiency, that he is of opinion, "were it not for the fixed stars, it would be *extremely difficult if not impossible* to prove the annual motion of the earth. We should conclude, that the planets made a complete revolution between any two similar situations with respect to the sun, because the spaces of elongation are similarly described, and are in quantity the same, whether the earth be in motion or not. It is from the apparent motion of the sun with respect to the fixed stars, that we *conclude* that the earth describes an orbit in about 365 days." Unfortunately however for their system, there is greater reason to conclude, *from this appearance*, that the sun has a motion, than that the earth describes an annual orbit, for, *there is no appearance* in favor of the latter.

"The strongest objection" (say the Newtonians) "that can be made against the earth's motion round the sun, is, that in opposite points of the earth's orbit, its axis, which always keeps a parallel direction, would point to different fixed stars, which is not found to be fact. But this objection is *easily* removed by *considering* the *immense* distance of the fixed stars in respect of the diameter of the earth's orbit, the latter being no more than a *point* when compared with the former"! This truly is disposing of an objection with a wonderful facility, for a space, according to them, of no less than one hundred and ninety millions of miles in diameter, is disposed of under a single point! Now, according to the geometers, a point is a quantity so small that it has no divisible parts. Reader, reflect for a moment upon this immense distance of one hundred and ninety millions of miles. A ball with the same velocity with which it is shot from a cannon would not reach the end of it in less than about forty five years; and we are, notwithstanding, seriously assured by these enormous calculators, that the globe, on which we live, annually passes the extreme points of this amazing orbit, without our being able to perceive the least alteration, no not a hair's breadth, in the bearings, distances, or magnitudes of those supposed quiescent bodies the fixed stars! This certainly is worthy to be classed with that other Newtonian assertion, namely that a globular quantity,

of an inch in diameter, of such air as we breath here in England ; or in other words about the tenth or twentieth part of what a man's mouth would contain, if expanded to the degree of rarity, which, according to their mathematical calculation, it *must* have at the height of about four thousand miles over our heads, it would fill all the planetary regions even to the very sphere at Saturn and far beyond ! or with his notion concerning the porosity of bodies, where he further asserts, " that this whole globe of earth, nay all the known bodies in the universe together, as far as we know, may be compounded of no greater a portion of solid matter, than might be reduced into a globe of one inch only in diameter, or even less." Amazing!! wonderful philosophy!! The shortest, and most certainly the wisest account of the matter would be, to assert that, He who, out of nothing, spoke the whole into being, is able, when the proper time arrives, to speak it into annihilation.

What poor pigmies in the art of calculation, were the ancients when compared with the wonderful expansive powers of the moderns ! To crown the wonders of this philosophy, we are now seriously given to understand, by one of the most celebrated astronomers in the world, that there is much reason to suppose that the spots upon the sun have been a chief cause of the late scarcity of provisions !

" Who" (saith the scriptures) " hath measured the waters in the hollow of his hand ? and meted out the heaven with the span, and comprehended the dust of the earth in a measure, and weighed the mountains in scales, and the hills in a balance ?" The advocates for the doctrine of gravity would not hesitate to answer, that Sir Isaac Newton, by his mathematical principles of natural philosophy, had not only measured the waters, air, heat and light, without stirring from his chair, but also, by the same principles, without scales or balance, he could weigh, not only the hills and the mountains, but also, the great globe itself, and that with *mathematical exactness*. Moreover, he could tell with ease, not only the gross weight of Jupiter, Saturn, and the rest of the planets respectively, but also the proportionate weight of a cubic inch of each ; nor could the flaming matter and dazzling splendor of the sun prevent

him from ascertaining his specific gravity, and his weight is two hundred and twenty seven thousand that of the whole earth !

Sir Isaac Newton borrowed his principles of motion, as applied to explain the solar system, from Galileo, Kepler and Huygens; principally from Kepler, although the latter we are told, gave up those principles of his own invention and substituted others as the causes of the planetary motions. This Kepler supposed the planets to "be huge animals who swam round the sun by means of certain fins acting upon the ethereal fluid, as those of fishes do in water; and agreeably to this notion, he imagined the comets to be monstrous and uncommon animals, generated in the celestial spaces; and he explained also how the air engendered them by an animal faculty. He looked upon three grand things as deserving his particular attention; the firmament of the fixed stars, the sun, and the enormous interval which separates them; these appeared to him to be a symbolical representation of the Trinity; and the spherical figure of the Universe, which comprehends the whole, he considered as an image of the supreme being. Such are some of the extravagancies of modern philosophy. The book of truth says, "Thus saith the Lord, the heaven is my elevated throne and the earth is my footstool (or *ref*); all these things hath mine hand made. To whom then will ye liken God? or WHAT LIKENESS WILL YE COMPARE UNTO HIM?" Kepler has told us.

Notwithstanding these preposterous notions of Kepler, and his astrological and other extravagant opinions, Newton did not hesitate to adopt such productions of his fanciful genius as suited his own fanciful system. And he accordingly laid hold of Kepler's conjectures concerning gravitation, the supposed elliptical form of the planetary orbits; the relation their periodic times had to their distances, and the operation of the moon upon the tides; and he shaped these materials with others borrowed from Pythagoras, Galileo, and Huygens, as best suited his purpose; introducing them with his own cement into different parts of the structure, and forming altogether that universally admired fabric of human contrivance—the *system of universal gravitation and attraction*. The reveries of Kepler, concerning motion and attraction, would, I am of



opinion, quietly have sunk into oblivion, had not some of them been necessary in the construction of this system, but, as they were indispensably so, it was consistent to pay some tribute of praise to his memory, along with all those who had furnished any materials for the work; and we are accordingly assured by a writer whom I have already noticed, in his zeal for the credit of the modern school, that "Kepler was the *first* who perceived that all motion is naturally performed in a straight line, and that when a body moves in a circle or any other regular curve, it must be acted upon by two forces; one which sets it in motion, and another which opposes this motion and changes its direction. From these principles and a number of calculations equally difficult and laborious, he *proved*, that the planets *must* revolve in elliptical orbits, the sun being placed in one of the foci; and that their velocities are such, that a line drawn from the sun to the planet" (in the manner of the string and the ball already mentioned) "and supposed to move with it, will describe equal areas in equal times." This is the very foundation of the solar system established by Newton. But, *if what this writer assured us to be true*, how stupid mankind must have been not to have observed, in the space of more than five thousand five hundred years, that a heavy body in falling to the earth, naturally does so in a straight, rather than a zig-zag, line. That a stone, or an arrow, well aimed at a mark, moved in the direction of it, instead of a contrary one; and that a body would not describe a circle without having reference or attachment to, or by, a force directed to a center. Certainly a little experience must render these things obvious to a child; but, the truth of the matter is, the philosophers of antiquity never thought of such curious refinements upon obvious motion, and would have smiled with contempt at the puerile absurdity of applying such reasoning to account for those motions of the heavens, which, they were well satisfied, were above human search, and could only proceed from the wisdom, power and constant energy of the eternal God.

Concerning gravity I shall endeavour to make a few plain observations, and then proceed to notice the methods used by the Newtonians for ascertaining the distances and magnitudes of the sun and moon.

The power called, gravity, according to these philosophers, acts with a force proportional to any assigned distance; or, in other words, its strength decreases in the reciprocal duplicate proportion of the increase of distance; that is to say, if several distances bear to each other proportions expressed by the numbers one, two, three, four, five, and each of these figures multiplied into itself, will show the proportionate strength of gravity at each of those distances respectively; for example, two multiplied by two gives the force of gravity at the second distance from the sun or planet to be  $\frac{1}{4}$  only of what it is at the first distance, and five multiplied by five makes the power at the fifth distance to be only  $\frac{1}{25}$  part of what it is at the first distance, and so for any distance that words can express, or the mind can conceive.

The Newtonians teach, that the sun and all the planets possess this property in proportion to the quantity of matter contained in each; that the sun and planets individually send out their attractions throughout the whole solar system, acting and re-acting upon each other; and, that as the attractive power of the sun draws the planets, so the same property in the planets draws the sun, but each in proportion to its size and distance.

To prove this property in matter, of action and re-action, they hold that "action and re-action are always equal and contrary; or, the mutual actions of two bodies are always equal and in contrary directions. If a stone" (say they) "be pressed by the finger, *the finger is equally pressed by the stone*. If a horse draws a stone, *the stone draws the horse equally backward*, for the rope is equally stretched towards both!" This they call the third law of motion; but in passing a law which has so great a share in their system of the celestial motions, they have not made the least distinction between the inert matter of the stone and the principle of animal life which actuates the horse. Suppose a man awake takes hold of another man asleep and drags him about a room, according to the reasoning of these philosophers, the latter pulls equally with the former. I should be inclined to reason thus, (perhaps not strictly philosophical, according to their school,) the inanimate stone and the sleeping man are both *passive* and do not *draw* at all, but are merely *drawn*.

Awake the man, and put Promethean fire into the stone, and then indeed both sides may be upon an equal footing, and pull in opposite directions.

I have just observed that, according to the Newtonians, the primary and secondary planets each of them act upon all the rest, and upon the sun itself—disturbing one another in their respective orbits—accelerating and retarding each other's motions according to their relative situations; and that by the same means, in a similar degree, the planes of their respective orbits are changed, as well as their periodical times. The inequalities, thus caused, are said to be, for the most part, corrected in a single revolution: they do not however clearly make known by what occult quality this is effected, for certainly there is not any known principle of motion that will explain it. Whirling a ball round the finger, or tying a pebble to a mill-stone, as before mentioned, is very little to the purpose; such are however their illustrations of the matter.

This doctrine of mutual attraction appears to me to be utterly subversive of their system; suppose, for example, a conjunction of Jupiter and the sun, with respect to Saturn, and that Jupiter, by a powerful attractive force ascribed to Saturn, is disturbed and pulled out of the orbit which he would otherwise describe, according to the doctrine of centripetal forces before noticed. I cannot conceive how Jupiter would regain his proper course, for if the action of Saturn should draw him a single mile, that action would then be encreased, and would continue to encrease, according to their own doctrine, in the reciprocal duplicate proportion before mentioned; whilst at the same time the power which should have retained Jupiter in his orbit would decrease in the same proportion. However, by mutual perturbations and affections, such as these, the planets are said to move neither in regular circles nor ellipses, but in a kind of zig-zag curves, which are always concave towards the central body.

The same system of gravity and attraction teaches that the sun is not absolutely the centre of the planetary motions, but that there is a point, about 4 or 500,000 miles from the sun, which is the common centre of gravity of the sun and planets; about which they

all perform their revolutions, according to the laws of gravity and attraction already noticed. This removal of the sun from the centre of the system, is said to be affected by the third law of motion—action and re-action;—for, as the sun draws the planets, so the planets draw the sun. This motion was intended by Sir Isaac Newton to correct, or explain, certain inequalities supposed to take place in the planetary motions, which, after all their optical discoveries will be found to be optical mistakes. Now, from one consideration alone, the motion attributed to the sun by the action of the planets upon him cannot I conceive be at all admitted; for, the planes of all the planetary and cometary orbits, according to the solar system, differ from each other in position; that is to say, they have different inclinations; the motion of their nodes, respectively; their distances; their magnitudes and periodical times, are all different from each other; and consequently these bodies, individually, would act upon the sun in a variety of contrary directions, which would inevitably prevent a regularity in his motion about the common centre of gravity, and also destroy all harmony in the system.

Professor J. Robinson, in his paper on the *Georgium Sidus*, published in the first volume of the *Edinburgh philosophical transactions*, asserts, that *all the irregularities in the planetary motions cannot be accounted for from the laws of gravitation*; and the French astronomer, La Lande, has also observed some *unaccountable* inequalities in the motion of Saturn for more than 30 years past. The system, therefore, is defective; it is insufficient to account for all the appearances, and therefore as a theory it ought to be exploded.

But, I am aware, some will object to me the supposed operation of the moon upon the tides. I deny the reality of it, and shall beg leave to offer a few of the many proofs which I could adduce, if time would permit, of the fallacy of that doctrine which philosophers acknowledge to be “the only *vulgar instance* we have of the *mutual gravitation* of the celestial bodies.”

It is asserted that “the sun's influence in raising the tides is but small in comparison of the moon's; for though the earth's diameter bears a considerable proportion to its distance from the moon, it is

next to nothing when compared to its distance from the sun ; and *therefore* the difference of the sun's attraction on the sides of the earth under and opposite to him, is much less than the difference of the moon's attraction on the sides of the earth under and opposite to her : and *therefore* the moon *must* raise the tides much higher than they can be raised by the sun."

Let these *therefore*s be examined by the laws of attraction as established and taught in the Newtonian school. This philosophy lays down as positive truths, that the sun and all the planets attract each the others in the exact proportion of their respective quantities of matter ; and that the power of attraction decreases as the square of the distances increases. Now according to the solar system the sun contains 9,100,000 times more matter than the moon, and his distance from the earth is 400 times greater. The square of 400 is 160,000 ; of course the attraction of the sun upon the earth, supposing him to contain exactly the same quantity of matter as the moon, would, at the above mentioned distance, be 160,000 times less than that of the moon ; or in other words the sun ought to be 160,000 times larger than the moon to have an equal attraction ; but it is contended that he is 9,100,000 times larger, consequently the comparative effect of his attraction to that of the moon would be as 9,100,000 is to 160,000, or as 57 is to 1.

In such a case I would ask, what sensible effect could the moon's attraction have upon the tides ? surely it is a demonstration that the sun's vast attraction would so absorb the moon's comparatively weak attraction as to render its effect nearly, if not altogether, imperceptible.

The reasons, we are told, why the sun's attraction is scarcely perceived is owing to its being nearly equal and universal over the earth's surface on account of his immense size and distance, but the moon, says a philosopher, " because of her distance in comparison to that of the sun from the earth is very small, the forces with which she acts on different parts of the earth will vary more considerably from parallelism and equality." Then I would ask why the tides are not higher between the limits of the moon's declination north and south,

than they are beyond those limits towards the poles? from the testimonies of voyagers the reverse is known to be the fact, and it is totally inexplicable by the principles of gravity. It is possible, (if the principle be admitted,) to conceive, that the sun's attraction might not be perceptible on the earthly parts of matter, owing to the equality of its operation from his vast size and distance: but then if, as we are told, gravity acts in straight lines and becomes manifest by the fluidity of the water on the surface of the globe, the amazing force of the sun's attraction would be abundantly evident because the power, being 57 times that of the moon, must necessarily communicate such an amazing agitation to the ocean as would render it completely unfit for the purposes of navigation.

If the force of attraction in the moon move immense oceans of water, why is it not able to communicate some small degree of motion to watery clouds suspended in the air?

If the waters are not sensibly elevated in the Baltic or Mediterranean seas, by the moon's attraction, because they have small inlets and small surfaces, why is it different with the Red Sea which has a *smaller* surface and a small inlet. This last is situated very near to the Mediterranean sea, and I am told has tides of considerable elevation.

But, say the supporters of the Keplerian hypothesis, the agreement of the spring tides with the conjunction and opposition of the luminaries is a sufficient demonstration of the moon's attraction. It appears to me to be a greater proof of the provident care and wisdom of the creator than an effect proceeding from a mechanical cause. The very unevenness on the surface of the earth, such as the mountains and the beds of the rivers and seas, as well as the movement of the waters, must have been formed with design and by the express power and appointment of God; for, if they were left to mere mechanical causes and accidents, we may easily conceive the fatal consequences which would necessarily result from such a system of things. God has appointed to all things their proper limits, and this divine philosophy is emphatically indicated in the passage where it is demanded of Job "who shut up the sea with doors when it

brake forth, as if it had issued out of the womb? when I made the cloud the garment thereof and thick darkness a swaddling band for it, and brake up for it my decreed place and set bars and doors; and said, HITHERTO SHALT THOU COME, BUT NO FURTHER: AND HERE SHALL THY PROUD WAVES BE STAYED. God has providentially appointed to most parts of the habitable globe, as he has seen needful, an extraordinary elevation of the water for several days every fortnight; this, added to its monthly coincidence with the full moon, is of the most essential benefit to mariners in navigation, particularly about the coasts and harbours, and is beyond comparison a greater proof of the beneficent design of God than it is of the fortuitous effects of such a power as gravity. But, according to Mr, Brothers, the ebbing and flowing of the sea is attended with benefits incomparably greater than these I have mentioned. "The flux and reflux of the sea," says he, "or motion of the water from the tides, by the regular ordination of providence from the beginning of time, is to keep the sea sweet by circulation, like the blood in the human body, and not by the pressure of the moon at the immense distance it is, as vain speculative philosophers suppose, though its full and change are made to correspond with the tides by the primitive order of providence."

Another confirmation of the fallacy of the system of planetary attraction arises from the result of its application to account for the cometary motions. In the early part of the late century, when the system became pretty generally received, several of those mathematicians who had adopted it, examined such accounts of comets as history has recorded; and, in a catalogue of several hundreds, a few seemed to have appeared at nearly equal periods from each other, under nearly similar circumstances. This apparent coincidence was with avidity laid hold of as seeming to confirm some former opinions, that comets were lasting bodies, as the planets, having fixed uniform periods; and, from their apparently near approach to the sun, Sir Isaac Newton very naturally incorporated them with the system he so eminently laboured to establish. The sun being placed in the centre of it, he very consistently asserted, that the comets performed their revolutions round him, according to his theory of gravitation and attraction. He accommodated them with elliptic or parabolic orbits according to the

length of time they were visible and the apparent velocity of their motion. It being received as an undoubted mathematical truth, that the distance of the sun from our earth is about ninety five millions of miles, the supporters of this system are obliged to measure the magnitudes, distances, and velocities of the other bodies belonging to it by that enormous scale: there was therefore no inconsistency in Sir Isaac Newton, when in comparing the motion of the comet of 1680 with those of the planets, he ascribed a velocity to it of 880,000 an hour! extravagant however as this is, it comes far short of the amount given by Mr. Brydone, of a comet seen by him when at Palermo in the year 1770; according to his computation that comet travelled at the rate of sixty millions of miles in a day; about 5,200 times quicker than a cannon ball, or seven hundred miles in one second of time!! Since the generality of Europeans as confidently believe these things, issuing from Sir Isaac Newton and other philosophers, as the Chinese believe whatsoever is promulgated by the grand Lama of Thibet and his priests, it is not surprising that the former, in their self-complacency, while exulting over the revelations of Newton, look down with contempt upon the simple philosophy and limited mathematics of the ancients, arrogantly exclaiming,

“ Nature and nature's laws lay hid in night ;

“ God said let Newton be, and ALL WAS LIGHT.”

The forms given by Newton to the cometary orbits, are quite incompatible with any *known* laws of motion and attraction. He says the sun's action upon bodies diminishes (and that consequently their gravities are less,) in proportion as they recede from him; or, in other words the matter contained in that body which revolves in the orbits nearest to him, is more powerfully attracted, and therefore heavier, than bodies performing their revolutions in orbits more distant from him. In conformity with this reasoning he asserts, that, on a comet's approach to the sun, its motion is accelerated, and that when it recedes from that luminary its motion is in a similar degree retarded, in the proportion I have already explained, that is, in the reciprocal duplicate proportion. If we calculate by this rule and admit, as Sir Isaac asserted, that the comet of 1680, when in its perihelion, or nearest approach to the sun, was within 150,000 miles of him, and that in its aphelion, or that end of its orbit most



distant from the sun, it was not less than 11,200 millions of miles, we shall find that the sun's attractive power upon it is above six thousand millions of times greater in the former than in the latter situation. I would ask then by what law of motion could the comet, being so powerfully acted upon, quit the neighbourhood of the sun and continue its rotative course? These philosophers may assert that it is effected by an equal impulse from the centre of gravity. I allow, in whirling a ball fastened to the end of a string about the finger, as a centre of its motion, that that centre communicates an impulse proportioned to the velocity of the ball; but this, although a Newtonian illustration, and supported by the fluxional calculus, will I doubt not be rejected by every truly rational man as preposterous and futile, when applied to explain those complex motions of the heavenly bodies which were originally communicated by the power and wisdom of their almighty creator.

To prove that the theory of gravitation and attraction is of no utility, when applied to make new discoveries in the celestial motions, we need only mention the failure of these two comets, the first of which it was confidently predicted would re-appear in 1758 or 1759, after a period of about seventy six years. In the year 1759 THREE appeared, all of which were quite unlike that of 1682; however, that the credit of Doctor Halley, and the system which he espoused and supported, might not suffer, *one* of the *three* was dragged in and declared to be the identical comet of 1682. The delay which took place in its re-appearance, was made up in the manner the Newtonians account for other differences which occasionally take place between the celestial motions and their calculations; namely, by the attraction of the superior planets, which disturbed the comet on its way, and drew it out of its course, causing it to be several months longer upon its journey than in describing former revolutions! so that this and similar instances, are failures in the divine order of the heavens! for who doubts the infallibility of the solar system, or the computations of those mathematicians who established it? Sir Isaac Newton considers the universe as a machine which gets worse for wear, and will in time be unfit for the purposes for which it was designed. Concerning the inequalities, which it is supposed have been discovered in the planetary and cometary motions, he.

teaches, "that these inequalities *must* constantly encrease by slow degrees, till they render at length the present frame of nature unfit for the purposes it now serves." A pretty compliment to the omniscient architect!

It is proper however to notice, that a celebrated astronomer of the present day, who some suppose has been raised up to put a finishing hand to such parts of the system as Newton left incomplete, has in some measure made a provision for these imaginary decays of the universe; for he is of opinion that the *nebulae* or *clusters* of stars, which are seen in various parts of the heavens, are the *laboratories of the universe*, where old crazy suns and systems are repaired and formed anew. Some of his words are, "We ought perhaps to look upon such clusters, and the destruction of a star (*sun*) now and then in *some thousands of ages*, as the *very means* by which the whole is *preserved* and *renewed*. These *clusters* may be the *laboratories of the universe*, wherein the most salutary remedies for the decay of the whole are *prepared*." Again, "The stars forming these extraordinary nebulae, by some decay or waste of nature being no longer fit for their former purposes, and having their projectile forces, if any such they had, retarded in each others atmosphere, may rush at last together; and either in succession, or by one general tremendous shock, unite into a new body." Here is a new sun, a mighty sun, supposed to be formed from a number of decayed ones! We may add—alas, what would in such a convulsion become of the worlds and their inhabitants who are supposed to revolve about and to be enlightened by these suns! they must of course rush along with the old suns and serve as fuel to light up the new one! But here another question very naturally arises; by what mechanical or physical process, in these laboratories, are new worlds and new people on them formed, to revolve about this new sun? I leave the solution of this to philosophers; and return to take notice of the other comet alluded to. This it was said might be expected to appear in the year 1790, after a period of one hundred and twenty nine years, but it has been looked for in vain. The sanguine expectations of astronomers were therefore greatly disappointed. These failures however they will not allow are any disparagement to the system, as their non-appearance to us might be owing (they say) to the unfavorable situ-

ation of the earth! These are easy methods of solving difficulties, or of defending erroneous calculations.

In the same manner as Sir Isaac Newton proved the relative forces of attraction, he contended, that the comet of 1680 was heated by the sun two thousand times hotter than red hot iron, and supposed that it (and other comets) would ultimately fall into the sun and serve as fuel to support the vigour of its light and heat. Some of his followers however of the present day, who differ from him in this particular, are not content to let the comets travel about those vast orbits, ascribed to them, without being peopled; and, as they cannot conceive it possible for human beings to exist upon the surface of a body which is so violently ignited as Sir Isaac *demonstrates*, they on the contrary endeavour to *demonstrate* that the sun himself is *not hot*, and that the comets are consequently as cool as the earth we live upon. They see *no* reason for believing that heat comes from the sun, while there is *much* reason for thinking that it does not. They contend that heat does not proceed with the rays of light from the sun, but that a sensation of what is commonly called *heat* is caused by a peculiar operation of the rays upon the bodies on which they fall! Very copious reasons for this extraordinary hypothesis have been laid before the philosophical societies, and applauded. It is not very unlike Sir Isaac Newton's doctrine of colors; he assures us that all bodies of themselves are colorless;—for example; when we see a leaf which communicates the sensation of green, it ought not, according to him, to be called a green leaf, but a leaf possessing a disposition of the particles of matter calculated to reflect green light! by the same analogy the face of a *British beauty* and that of a *Negress* are alike without any inherent colour; but, fortunately for the former, the particles composing the surface of her face have the property of reflecting a blooming red and white, while the latter reflects what we call black! Such are the reasonings made use of in these latter days to outrage and assail plain sense. They seem to me to be links of that chain of philosophical inanities which at one time would persuade man that he has no soul, and then that he has no body.

The world is very little obliged to these wise men for their sophistical refinements. What is the sum of their discoveries upon the two points just mentioned? It is, that light makes manifest colors, and that the rays of the sun cause a sensation of heat in the bodies upon which they fall. These things have been admitted by all nations in all ages; but then it has been the glory of these latter times to refine and to excite wonder concerning them. Notwithstanding however the great volumes that have been written, and the temporary fame of the authors, I am of opinion both the one and the other will be forgotten, and that man, in delightfully contemplating upon the vegetable creation, will agree with his maker, that it has *colors*, and that Solomon in all his glory was not so beautifully clothed. Nor will he see any impropriety in saying, in the simple though elegant language of scripture, that "the sun, when it appeareth, declareth at his rising a marvellous instrument, the work of the most high; at noon it parcheth the country, and who can abide the *burning heat* thereof. And man shall not only be conscious that he has a *body* and *soul*, but also, agreeably to the promises recorded in the book of truth, he will exult that they are become the habitation of the living God.

Mr. Brothers, in his divine publication, says, "as to the stars giving light to this earth, they certainly give very little, nor was it intended they should afford any more, the moon being solely appointed for that purpose; but they serve to beautify the heavens, and they afford exercise of knowledge as well as pleasing amusement to those that chuse to employ their leisure hours in the study of astronomy. These are the reasons, O faithless and unbelieving man, that thy maker created them for, otherwise they would be of no utility, and of course unworthy to be regarded! Learn from it, however, that as God is regular and beautiful in the heavenly system, he is fond of seeing a system equally regular and beautiful pervade all on earth, all the actions and works of man, for whom, and for whose entire use he created all things that the eye can perceive in heaven, or the mind justly imagine on earth—all agreeable to his own account in the first chapter of Genesis. But as to any suns, globes, and *fiery comets*, with the motion of the earth, it is all a falsehood, invented by weak speculative men, who rejected the

divine account of the creation, as too short and plain, to impose on the world a long, intricate, and puzzling one of their own. Surely nothing shews more clearly the nice regard divine providence has manifested for his people, than the salutary checks he has placed against an injurious excess of heat on the globe. Above the earth the regions of air are so excessively cold and strong, as to overpower and deaden so much the fiery rays of the sun, that when they fall on the tops of the highest mountains, though directly vertical, they have not the least sensible degree of heat to melt the snow which perpetually lies on them, such as the Alps, Atlas, and the Andes; and again, as they descend from that height to the surface of the sea, or low land nearly on a level with it, through weaker and weaker air, they gradually revive more and more until they reach the surface, where their force would be insupportable, had not the benignity of providence provided a cooling wind to make them tolerable to man, that most tender part of the creation. However, that heat, though troublesome, is necessary for the nature of the land in the different climates, and different places, to promote vegetation and an increase of all living things, that the wise purposes of providence may be fully accomplished for the general benefit of man and beast, fish and fowl. Here is a necessary repulsion of heat from the sun by the cold and stronger air above the earth; and here also is a necessary repulsion of cold again by the weak air and revived strength of the sun on the earth. O admirable! Now that the force of the sun's heat is so benumbed, though not utterly destroyed by the cold air it passes through, is clearly evident from the perpetual snow on the mountains I have mentioned, as well as many others; for if providence had not regulated his system in that manner, those chryselline cold bodies, the moon and stars, so far from being able to resist its heat, would fall under its power and be destroyed into vapour. This evidence again, which is clear to the eye, and plain to the understanding of every man, annihilates the opinion of Newton on the comets, who asserts, with equal confidence, but with equal folly, as he does on his plurality of worlds, that the one which appeared in the year 1680, was two thousand times hotter than red hot iron, and would retain that heat for twenty thousand years, though its supposed time of absence was only five hundred and seventy five years; its greatest calculated distance from the sun 11,200 millions of miles,

and its velocity—O wonderful! 880,000 miles an hour. The motion of our earth though swifter in miles an hour than a man can count numbers, is nothing to the motion of this comet. In point of comparison between objects on earth, it does not bear even a sufficient proportion with the slowness of a cow to the swiftness of a hare. The opinions and assertions of Sir Isaac Newton, as well as all others that support him, are erroneous: the comets neither fly with that velocity, nor are they heated in the least, but, on the reverse, their motion is regular round the earth, and swift only according to their distance, and the circle they describe every time they appear; in nature they are cold, and of a thick cloud—like red coloured vapour, ordained by providence to appear at stated periods, and most certainly for signs. Sir Isaac Newton asserts they are hard solid bodies, so excessively heated, beyond any thing we know, as to be able, from their nature, to retain their heat for the space of 20,000 years. An assertion quite contrary to all human experience of that element on earth, because all fire is kindled by combustibles of one kind or other, and consequently, as that body is consumptive, the fire would soon wear out, unless a fresh stock of matter was continually adding to keep it in." He observes in another place, that their disjointed and ragged forms are as utterly incompatible with the inconceivable velocity assigned to them, as the intensity of their heat added to that of the sun would be with the preservation of those cold chryselline bodies the moon and stars, or with animal existence on this globe.

It is a custom with modern philosophers, in order to give eclat to the offsprings of their own imaginations, first to demolish or dispose of ancient, or what they term *vulgar* opinions; accordingly they class with such all those who, agreeably to the word of God, view these extraordinary appearances as signs of approaching judgments, or revolutions of states; for, in their accounts of comets, they begin by noticing that, "their strange appearance has, in all ages, been a matter of terror to the *VULGAR*, who uniformly have looked upon them to be evil omens, and forerunners of war, pestilence, &c." Thus after having by a stroke of ridicule disposed, as they think, of the divine power and interference, as having nothing to do with these appearances, they immediately endeavour by the power of at-

traction and gravity, aided by their profound imaginations, to conjure up the most alarming (*though learned*) bug-bears; in comparison to which, the fears of the *vulgar* bear no greater proportion than the report of a pistol to a loud clap of thunder. Concerning the comet of 1680, the celebrated Dr. Halley asserts, that if the earth had been in a certain part of its orbit, near which the comet passed, "their mutual gravitation *must* have caused a change in the plane of the orbit of the earth, and in the length of our year, and if so large a body with so rapid a motion as that of this comet, were to strike against this earth, *a thing by no means impossible*, the shock might reduce this beautiful frame to its original chaos." Alas, alas! surely such a terrible catastrophe could not possibly take place, unless peradventure, the gods of these philosophers should happen to be absent many TRILLIONS and BILLIONS of miles, repairing other wrecked or damaged worlds, in what they are pleased to term the *laboratories of the universe*? Whiston endeavoured to establish an opinion, that a comet was the instrument used to drown the world. That another struck it upon its surface and gave it a rotative motion upon its axis which it is said to have had ever since. A third on its passage from the sun he believed would burn the earth up! Were the *vulgar* generally to adopt the teachings of Halley and Whiston they would indeed very naturally be terrified at the appearance of a comet. Is the care of the creator of the universe continued over all his works? Reason, as well as revelation, gives abundant proof that it is; and that they are not liable to that mechanical derangement and destruction which we are taught to believe by the Newtonians. The men of truth may therefore rest assured, that notwithstanding the dreadful accounts of modern philosophers, *their* comets are perfectly harmless, being merely generated in their own imaginations.

I now return to make a few more remarks upon the theory of attraction and gravity. I am decidedly of opinion that whenever the learned shall diligently consider it in all its bearings, and shall have courage candidly and openly to declare their true sentiments upon the subject; (for literary characters would certainly risk their reputation by dissenting from the Newtonian faith,) I say whenever this shall be the case, I am persuaded the doctrine of gravity and

attraction will fall into contempt, and experience the same fate as  
ANIMAL MAGNETISM.

MESMER and his pupils taught, that animal magnetism was an universal fluid diffused through all nature, and the medium of all mutual influence between the celestial bodies, and between the earth and animal bodies. That there was in nature but one disease, and one cure, and animal magnetism was that cure,

The Newtonian school teaches that ATTRACTION is a something that runs through all nature, so subtle that it penetrates the inmost recesses of all matter in the sun and planets, as well as the spaces in which those bodies perform their revolutions; and that it not only corrects all their disorders and irregularities, but it is also the *cause* and *guardian* of all their continued motions. They do not even hesitate to declare their belief of its all-sufficiency, thus to operate, without the immediate directing hand of the creator, for, says an able advocate for it, "Phenomena are wanting to determine whether attraction depends on the immediate fiat of the deity, or on other intervening causes. The latter is most probable, but the reasons on which that probability is founded cannot be discussed in this place!"

Another astronomer, one of the most celebrated mathematicians of the last century, goes still further; while extolling the advantages of astronomy, he gives this remarkable passage in the preface to his book. "This likewise, of all things, gives us the justest notions of the wisdom and power of the deity, that can form such a vast system, and continue it in motion for so many ages. For though the mere laws of gravity are sufficient to keep it going, when once put into motion; yet mere mechanical laws could never give it those particular motions at first; there wants a first mover to do this." Thus, O reader, these men who are looked up to as the lights of the world, plausibly endeavour to persuade mankind, that the superintendence of the creator in the natural world is not to be considered as at all necessary. Others as plausibly endeavour to convince us, that his presence is equally unnecessary, and as little concerned in the order of the moral world. David, however, as it is written in the Psalms, had a different idea of the matter, and for my own part I freely join



with him, "Whither (says he) shall I go from thy spirit? or whither shall I flee from thy presence? If I ascend up into heaven, thou art there: if I make my bed in hell (or, *the common receptacle of the dead*) behold thou art there. If I take the wings of the morning and dwell in the uttermost parts of the sea; even there shall thy hand lead me, and thy right hand shall hold me. If I say, surely the darkness shall cover me; even the night shall be light about me; yea, the darkness hideth not from thee; but the night shineth as the day: the darkness and the light are both alike to thee."

Compared with the Newtonian hypothesis, the empire of ANIMAL MAGNETISM was short-lived; principally for two reasons. For some time it spread so rapidly, and was so favorably received, that it seemed to threaten the interests and influence of a large body of men—the physicians; their jealousy was accordingly awakened, and, being joined by the philosophers, they made a very formidable and successful attack upon it. And, being open and easy of detection, its supporters were soon defeated; and then, as the immediate consequence, their system was completely exploded. The chimera, GRAVITY, on the contrary, being chiefly employed in the celestial regions, has little to do with the sublunary interests of mankind, excepting the few speculative geniuses who have profited by the temporary distinction to which they have been raised by exciting the wonder of their admirers or patrons. The thing has generally remained unmolested on this account, as well as by reason of its being so ingeniously fortified by a species of mathematical reasoning which has rendered it completely unassailable, not only to the great mass of mankind, but also to the mathematicians themselves, unless attacked in the very foundation.

"Sir Isaac," (says Mr. Brothers) "by his laws of gravity destroys his system of motion. Such a thing is very well for the creed of an ignorant man, an enthusiast, or a speculative man to brood over; but I hope now every man of sense will despise it as false. To make good the law of gravity, or the feeble power of attraction under the best plausible form, the earth should be at rest, otherwise it cannot be. For indeed no heavy body could fall straight down, or from a perpendicular height, if the place it was to fall upon was in motion;

as the earth, by its quicker movement in going forward than the heavy body in falling, would leave it far behind the place it was directly over. In short, as the weight of any body however heavy and solid, from any height, not to mention water that is quite loose and very light, would not fall so quick, it stands to reason that the much quicker motion of the earth, aided by the vehemence of the wind, would leave that body (suppose a ton of iron, and one mile high) full forty four miles behind, from its first perpendicular height, before it touched the ground: it could no more rest on the earth short of that distance, than a pound of cork from the same height could rest on a fleet horse in full gallop directly under it. Surely it is as plain as the fingers on the hand, and as easily understood, as that the intention of the mouth, when it receives food, is to prepare it for the stomach."

A true Newtonian philosopher will attempt to dispose of this objection by assuring us that the earth has an atmosphere of about forty five miles in thickness, which is carried about with it, as a man carries his coat; that within the compass of this atmosphere, every thing in earth and air partakes of the motion of the globe, and that a drop of rain, or a particle of air or smoke, is carried forward with the same velocity as the point of a solid rock, notwithstanding we daily see smoke and vapour driven about by the wind from all points of the compass. All without this airy coat, Sir Isaac Newton says, is a perfect vacuum, or, what amounts to the same thing, a space wherein the earth (without experiencing any, the least imaginable resistance, such as is known to retard a stone thrown from the hand, or a ball shot from a cannon) flies more than 140 times faster than the ball from the mouth of the cannon! without admitting this doctrine, of void space in the celestial regions, their system of incredible motion cannot stand a moment's sober consideration, and unfortunately for it all observation and practicable experiment have tended to shew the contrary.

It has been attempted by different means to ascertain the height of what is called the atmosphere. By means of the Torricellian tube, and other experiments, it is said air was discovered to be a gravitating substance (has a sensible weight) and that its rarity increases in

gument (say the philosophers) for *at least equal density* of the atmosphere in the *superior* as in the *inferior* regions." Fires are found to burn as intensely on the tops of the highest mountains as on the plains. There was indeed an eminent instance of this in the memorable eruption of Vesuvius in 1779, where, though the lava spouted up to the height of three miles above the level of the sea, the uppermost parts all the while were to appearance as much inflamed as the lowest. I have collected these few observations to shew, that Sir Isaac Newton's theory of "void spaces" for the earth and planets to move in, rests if possible upon a more rotten basis than the other fundamental principles of his system. He very well knew, from common mechanical principles, that his system of the celestial motions would not bear the resistance of a medium the thousandth part of the strength of common air, therefore it behoved him to set limits to a certain space called an atmosphere.

"A cannon ball (says Mr. Brothers) is calculated to fly at the rate of four hundred and eighty miles an hour, and makes by that velocity a strong sharp wind to the distance of about two inches from it. What enables me to be so accurate is, a young gentleman, in the ship I was in, was killed on the 12th of April, 1782, by a large shot passing so close to his open breast, that the shirt was grazed and the skin, though not perceptibly wounded, was turned quite black as if the blood was stagnated—his death was instantaneous; the part most affected was opposite the heart; his age was twenty, and his merit great. But how much stronger in fury would the wind be that the globe would make, when its greater size is taken into consideration, and flying one hundred and forty one times swifter than the ball from a cannon. The globe flying so many times faster than the shot, and more than three hundred times faster than the most violent hurricane ever known in the West Indies, would, as it plainly stands to reason, make such a furious and mighty hurricane of wind as would blow away man and beast from its surface, level every building with the ground, and tear away the deep-rooted trees of the forest. That would not be all, such a continual wind acting with so mighty a power on every loose body in its way, would soon blow the sea out of its channel, the whole of it away to the north pole," (because the motion onward would be more than sixty times quicker

than that upon its axis) "until every drop was blown off the earth. This the power of the wind alone would effect, because its force would be much greater than the power of gravitation in the water to retain its place, on the parts of the globe assigned by providence to it."

"But again, the motion of the earth alone, even admitting it had the supposed motion without making a breath of wind, would be so very quick, that it would fly away from the water and leave it in a long tail behind, the velocity of the earth being too strong for the ocean to keep its place." (for the force of gravity in one second upon the earth's surface, is only about sixteen feet, while that of the earth's projectile motion is said to be about sixteen miles in the same space of time.) "For let it be considered that the water is light, loose, and not only ruffled with ease by every storm, but is also easily divided by fishes, boats, and the largest ships sailing through it: There being then no continual hurricane of furious wind, nor the sea moved out of its channel, but we live and walk, our houses stand firm, our trees grow, our cattle feed, and our ships sail to various parts of the world over the ocean with various winds, prove beyond all contradiction, that the solar system is erroneous, and that the earth does not move one inch in its orbit; but if it really did fly with the velocity asserted, it would be impossible for man to live, or any thing on earth to grow: there could be no existence, nor any thing that there is now. As nothing could grow on a body flying so fast even as a shot from a cannon, and as a man could not save his life in falling down the height of a mile, how then could vegetation grow on the earth if it flew one hundred and forty one times faster than the shot; or man be able to live on the earth if its motion caused a perpetual hurricane two hundred and fifty times stronger than the velocity of a fall which would deprive him of life? If it was possible to make a round body of water, of any size, it could not bear to be set in equal motion with a cannon ball that does not fly so fast as the globe by one hundred and forty one times and a half. How then in the name of Heaven could Sir Isaac Newton, so celebrated a character, think for a moment that any law of gravity—or any power of attraction, would keep secure in its channel so loose, light, and changeable a body as

water, especially when the power acting upon it would be so many times stronger to remove it? His whole system is nothing but error and contradiction, and equally vain, as if he had wrote on the possibility of building castles in the air.

"He (God) called our visible water from created vapour like thick clouds; our earth he called and formed from nothing, therefore the water is made to be on the earth by the power of his word alone, and not by the law of gravity and attraction as Sir Isaac Newton asserts. And as all things that spring from the earth, whether man or beast, tree or herb, fish or fowl, must by the regular law of the creation return to it again, so the earth by the divine word, when decreed, vanishes to nothing. All things in heaven and earth were regulated by the wise order of Providence at their creation—the course of the sun round the earth for light and heat, as also for the regular and perpetual changes of seasons—the course of the moon also shewing its regularly perpetual increase and decrease, as the earth interposes between it and the sun—the regular and perpetual course of the stars also. When God assigned them their respective places for their respective uses, it was also that they should never deviate from their regular course by approaching a mile nearer or going off a mile distant: he did not leave his works so imperfect as to require any amendment from man, or that they should be brought under subjection whatever to their mathematical opinions, or to their fine-spun laws of gravity and attraction."

"The heavenly bodies, the stars, sun, and moon have no attraction one to the other, nor to the earth, nor again the earth to them; nor could any thing at the height of five miles possibly fall on this earth, the current of cold air at that distance even, (to qualify the rays of the sun,) being too buoyant and strong to admit the falling of any, even the most ponderous body on the globe." (It does not appear to me that any one can reasonably doubt this, when it is considered that hail-stones have been concreted, and suspended, at probably not more than two or three miles high, so astonishingly large as in their descent to destroy man and beast and even to split large trees. Several such accounts seemingly well authenticated are on record; on the contrary near the surface of the earth the small-

est drop of water cannot be suspended in the air.) " They have no attraction whatever one to the other, but are all independent bodies moving round the earth in their respective regions and circles, as providence wisely designed at their creation : neither in the opposite sense do they possess any power of repulsion. If they possessed the former, and all bodies were regulated by it, as Sir Isaac Newton asserts, then all the lesser bodies would be attracted to the greater as to their common centre, and would stick fast like needles to a load-stone ; neither have any the property of repulsion, for if they had, the greater would drive off to an immense distance and force into irregular courses the lesser ; one would effect the other, until a general confusion prevailed throughout the whole."

" If we admit a power of attraction in the solar system of the universe, as serious and reflecting men, we must give all to one planet as the common centre, or give a proportional share to the whole. Take it either way. Now it is plain, that if the whole was lodged in one body, all the planets would be drawn to a close union with it : and if the whole force of attraction was divided with a proportional share to each, then all lesser planets would fly from every side to the greater in a jumbled state of confusion, unless there was put in opposition to the power of attraction, an equal power of repulsion : the effects then of one being to destroy or balance the other, it is evidently plain, either alone would be improper, and both together useless."

" That the planets are now in their due course, and have been preserved in that regular state since the creation, proves to every body they possess no more power of attraction, or even repulsion, than a number of men walking the same road together. Neither does the earth or sun possess any, for the reasons already advanced ; for not a planet is nearer to either, or more distant than when they were made. Here, to the planets only, the principles of Newtonian attraction has rested, forgetting that, like man, so strong a body must derive its effect from the first source of nature, and by resting so far short, if there was any such power in the planets, Newton has shewn himself a defective man. But if we join true wisdom to the former qualities of seriousness and reflection, we shall carry the power of

attraction, which I call the law of creation, higher than the planets, and place it in God himself as their universal centre, and universal creator, by whose wise disposition all the heavenly bodies move in a constant and most regular order, comparatively like the wheels of a clock for the measurement of time. But as to any other law of gravity or power of attraction than his law of order at the creation, it is an idle farce, a palpable imposition to think of. He said to the earth, be at rest; and it is so: The sea to cover the necessary parts of it; and it is so: but in all that, there is no law of gravity or power of attraction; but entirely the fixed regular power of his work to keep the globe suspended in the heavens, with the sea surrounding the necessary parts of it. He said also to the sun, keep always in motion to give light and heat, to give changes of times and seasons to man that inhabits the earth! and it is so. He said to the moon and stars, keep always in motion in the courses, and to give the light by night I have ordained you for; and it is so: but in all that, there is no law of gravity or power of attraction, no more than in the growth of a human being, whose head points to the firmament, and whose feet rest on the earth; but entirely the absolute power of his word."

"As to gravity or attraction extending to the earth as a body, the sea as an ocean, the sun as a bright created fire, the stars as chryselline solid bodies, is a very great error. But that a piece of iron would be attracted by a loadstone is certainly true; but what has that to do with the earth as a body fixed, or the sun, moon, and stars as moving ones? The earth is not a loadstone, nor are the planets made of iron, amber, or any other materials to produce the least force of attraction with the earth. It is idle also to suppose a power of gravity with respect to the earth and planets, because a stone falls from the surface of the water to the bottom, a piece of iron from the top to the bottom of a pit, and a pear, on which Newton built all his erroneous, but fine-spun notions, falls from a tree to the ground. They naturally fall so by their own weight, as a man deprived of life would fall flat to the ground, or sink to the bottom of water, or to the bottom of a pit; but what has that to do with gravity or attraction, or what analogy does it bear to the motion of the planets, or the regular system of the universe?"

Surely none. If they flew upwards instead of sinking into water, or down into a pit, or falling to the ground from a tree, then there would evidently be a power of attraction; but as there is nothing of that, but on the contrary, all things being regulated by the divine law of nature, or creation, all things so respectively affected, must inevitably return to their origin, the earthy part to the earth, and the watery to the water: whether a stone thrown into the sea, a ton of iron into a pit, a gallon of water into the fire, or pears dropt from a tree, not an atom of one, or drop of the other, can possibly be wasted or prevented in any artificial shape from returning to its origin. Where then is the boasted law of gravity and power of attraction to resist the general law of creation? There is none—there never was, nor ever will be any. If the earth had a central gravity, all springs of water would go down, instead of rising up to the surface. The terms are artificial, produced from a wrong conception of things, that Sir Isaac's understanding could not either justly comprehend or seriously believe. His literary abilities imposed on his country, and his great eminence for mathematical calculations, procured him that applause, instead of reprobation, for overthrowing the true system and substituting a false one, which would have infallibly ruined the fame of a poorer man for attempting. He has with great regularity laid down a plan of his own invention, and as no one coming after has possessed equal abilities for strong and subtle reasoning, he has, with astonishing credit and approbation, imposed the blackest falsehood against God and the christian world that was ever done before."

Thus far concerning motion, gravitation and attraction. Much more might have been said upon the subject; but to the ingenious mind, desirous of examining for itself, and unbiafed by the high-sounding fame of any man, however eminent in public estimation, I trust sufficient has been said to shew, that the immortality of fame, so long assigned to the works of Sir Isaac Newton, may one day be compared with those false lights, which are said to have sometimes decoyed the unwary traveller into marshy and perilous places, delusive and short-lived.



I now come to take notice of the methods laid down by modern astronomers for ascertaining the distances of the heavenly bodies. If they fail in this point, which is purely mathematical, I would ask what attention ought to be paid to those parts of the system which at best, can claim regard only in proportion to the ingenuity of those speculative theories upon which they are founded. I shall state that method which is placed first in the *Encyclopædia Britannica*, and several other publications which are now before me. "We will begin first with the moon; (says one of them) this planet is nearer to us than any of the rest, and the method of finding her distance from the earth being once known, it will be easy to perceive that the distance of any other planet may be determined in nearly the same manner. The first thing to be done in the method I am about to describe, is to find the moon's horizontal parallax, or the difference between the place of the moon when she appears in the horizon, to a spectator on the earth's surface; and her place as it would appear to a spectator placed at the earth's centre. This problem is no less curious than the one it is meant to elucidate: it is the same thing as to find the angle under which the semi-diameter of the earth would appear, at a certain time, to an observer placed at the centre of the moon. That this can be done must appear very extraordinary to a person unacquainted with astronomical principles: but the determination, singular as it may seem, is far from being impracticable."

"Let us suppose an observer to be placed upon any point A, of the equator BAC, (*Fig. 2.*) at the time the moon moves in the equinoctial DMP, then, as this latter circle is in the plane of the former, the moon will pass directly over his head, and descend perpendicularly to the horizon EN. In this situation of the spectator upon the earth's surface A, the moon will appear to have described a quarter of a circle, or ninety degrees, in passing from the zenith M to the sensible horizon at N; but to a spectator placed at the centre of the earth O, she would appear to have described a quarter of a circle when she came to the rational horizon at P. But the moon revolves round the earth, from the meridian to the meridian again, in about twenty four hours and forty eight minutes; she will therefore revolve from M to P in six hours and twelve minutes; and if the time she takes in moving from M to N be found by observation,

and taken from fix hours, twelve minutes, the time of moving from M to P, the remainder will be the time employed in describing the arc NP.

" Having thus found the measure of the arc NP in time, we can convert it into degrees and minutes, as follows : as the time of describing the arc MN, which is found by observation is to ninety degrees, so is the time of describing the arc NP, to the degrees and minutes in that arc. But this arc is the measure of the angle NOP, or of its equal ONA ; for since the lines AN and OP are parallel to each other, it is a known property of geometry, that the angle NOP will be equal to the angle ONA. This angle ONA is called the moon's horizontal parallax, and as that is now found, we can easily determine the distance of the moon from the earth's centre. For it is a maxim in trigonometry, that when any three things in a plain triangle are known, except the three angles, the rest may be found by calculation.

" Now in the triangle AON we have the side OA, equal to the diameter of the earth, which from an actual mensuration of the circumference," (*part of the circumference this writer must mean, which I have already noticed*) " has been found to be about 3960 miles ; the angle ONA, or the moon's horizontal parallax, has also been found by observation ; and the angle OAN is a right angle, because OA is perpendicular to the sensible horizon EN. These three things, therefore, are known, and are sufficient data for determining the rest. The side of the triangle ON is the distance of the moon from the centre of the earth O ; and this distance, by a trigonometrical operation, is found to be, at a mean rate, about sixty semidiameters of the earth, or in round numbers, about 240,000 miles."

This is one of those demonstrative supports of the Newtonian system which we are required to believe, or be stigmatized by the inventors of it, as " the worst of heretics." I admit the thing is plausible enough in theory ; but in this, as in many other branches of science, it is easier to form ingenious theories, than to reduce them to practice ; accordingly the wit of inventive geniuses, fre-

quently amuses or astonishes the world, without communicating real instruction or benefit to society.

If there were no horizontal refractions ; no unevennesses upon the surface of the globe ; if the moon's orbit made no angle with the plane of the equator, and if time-pieces were perfect, this method might perhaps ascertain the moon's distance with tolerable exactness. But here are obstacles which it is impossible to surmount ; and I will venture to say that, *if it ever has been put in practice*, nothing satisfactory has resulted from it. Supposing the moon, according to the assertion of modern astronomers, to be 240,000 English miles distant from the earth's centre, the circumference of her orbit would be about 1,300,000 geographical miles, and her apparent motion about eight hundred and sixty miles in one minute ; the time she would therefore take in describing the arc NP, would be only about four minutes ; for the subtense of an arc equal to the semi-diameter of the earth at the distance of 240,000 miles from the earth's centre, would only be about fifty eight minutes of a degree, or nearly double the apparent diameter of the moon.

If, in applying this theory to determine the moon's distance, we suppose the observer to be elevated or depressed but a few yards above the average level of the sea, this alone would lead him into an imperceptible though important error. A person upon the top of a ship's mast can see the setting moon a considerable time longer than one upon the deck ; or one upon elevated ground can see her longer than another upon the plain below. The subtense of an angle, which, at the distance given by astronomers to the moon, would measure three thousand nine hundred and sixty miles, would at the distance of ten miles measure only two hundred and ninety one yards. Therefore an observer elevated that distance above the average level of the sea, (which, compared with the diameter of the earth, is no more than the smallest grain of sand compared with the diameter of an artificial eighteen inch globe) would see the moon full six hours and twelve minutes in describing her course from the zenith to her disappearance below the sensible horizon, in which case there would be no horizontal parallax, and consequently, according to the reasoning these philosophers apply to the fixed stars, her distance might

be said to be incalculable. I need not enlarge upon the extreme absurdity of any attempt to reduce this theory to practice. One of the publishers of it seeing it in some degree in a similar light, observes, "But the true quantity of the moon's horizontal parallax cannot be accurately determined by this method, on account of the varying declination of the moon, and the inconstancy of the horizontal refractions, which are perpetually changing according to the state of the atmosphere at the time. For the moon continues but for a short time in the equinoctial, and the refraction, at a mean rate, elevates her apparent place, near the horizon, *half* as much as her parallax depresses it." So here this is given up as insufficient; but as impracticable theory is the element of these speculative men, the same author goes on to tell us that "astronomers have thought of another method which is free from these objections; and if practised by able observers, with good instruments, is sufficient for determining the parallax and distance of the moon to a *considerable degree of precision*. I shall mention (says he) the most simple case first, and this will render the general method more clear and satisfactory. *Suppose* two observers were placed under the same meridian at A and B (Fig. 3,) at such a distance from each other, that the one at A sees the moon M in his horizon, whilst the other at B sees her in his zenith; <sup>det</sup> then will the distance of the moon OM and the horizontal parallax OMA, be easily determined. For the arc AB, which measures the angle O, is equal to the difference of latitude of the two observers; the side OA is equal to 3960 miles, the same as before; and the angle OAM is a right angle, &c. This" (adds he) "is the simplest solution the problem admits of; *but* as it may *not be easy* to *perceive* how the two observers can be placed in the manner required, I shall now give you a more general method, &c."

In this last solution, the author begins, by observing, that it is *free* from those objections which the first is liable to; *one* of the most substantial objections, he very properly observed, which might be raised against the first, was the horizontal refractions; now I would ask, does not the self-same objection attach to the second case, if one of the observers is to see the moon in the horizon? however it is not necessary to dwell upon this, since he admits that it is not "*easy* even to *perceive* how the observers can be placed in the

manner required." He then goes on to state the third general method, which is to be effected by means of two observers situated at any distance from each other under the same meridian. This method is the same, or nearly so, as that recommended by Mr. Ferguson as the best, but which, as it has never been put in practice, it is only loss of time to enlarge upon. In the method alluded to, it is proposed for one observer to be situated in the northern, and the other in the southern hemisphere, at a distance, from each other, of at least six or seven thousand miles. It is also taken for granted, that the latitudes may be ascertained to a mile, by a simple observation of the sun or polar star, without making any allowance for the difference between the observers station upon the surface of the earth, and the centre of the earth itself. A true Newtonian will however smile at this last remark, because as an article of his creed is firmly to believe, without the least doubt, as I have already stated, that 190,000,000 of miles are only a point when compared with the distance of the fixed stars, so he can with the less hesitation as firmly believe, that the semidiameter of the earth has no sensible proportion to the distance of the sun, and accordingly, with great consistency, it is scarcely noticed in their observations upon, or calculations of the places of the heavenly bodies.

Such seems to be the present state of the case concerning the knowledge modern astronomers have of the moon's distance; two methods produced by them are allowed to be quite impracticable, and the third has never been tried! We are notwithstanding required to give implicit belief to all the dogmas which their fanciful geniuses are pleased to promulgate. However, if the thing appears to be plausibly supported by mathematics, few refuse their assent, deeming it to be infallibly true.

I judge it to be quite unnecessary to enter upon the methods made use of by astronomers for determining the distances of the sun and planets: for, according to them, the distance of the sun is made to be four hundred times that of the moon, and the nearest of the primary planets, namely, Venus, is stated to be more than one hundred times the distance of the moon. If they cannot resolve the distance

of the moon, which is nearest, how can they determine that of any body that is more distant ? it is a folly to pretend to it.

The ancient astronomers endeavoured to find out the distance of the sun by the earth's shadow, at the time of a lunar eclipse, also by the phases of the moon. Hipparchus is said to have invented the former, and Aristarchus the latter. Their methods with some modifications have been used by modern astronomers, they are, however, now exploded to give room to another theory, for by their methods it is said the distance of the sun might be brought out 7,000, 7,700, 13,700, 70,000 semi-diameters of the earth, or infinite. I have just observed, that their methods have been exploded to give room for another, which was proposed to the Royal Society by Dr. Halley. I mean that of observing the transits of Venus over the sun. This was accordingly tried in the transits of 1761 and 1769. "At these times (Encyclopædia Brit.) the greatest attention was given by astronomers, but it was found impossible to observe the exact times of immersion and emersion, with such accuracy as had been expected ; so that the matter is not yet determined so exactly as could be wished." I would ask any rational man, what accuracy could be expected in the determination of an angle of  $\frac{8}{3600}$  of a degree or 8", from any observations made upon a luminous body such as the sun ? Even granting this method to be at all admissible, an error of one single second would be an error in the distance of nine or ten millions of miles !

I suspect, notwithstanding all the researches of philosophers concerning light, that from a wrong conception of the dimensions of the earth's shadow in lunar eclipses, caused by a privation of it, has originated all their grand errors concerning the distances and magnitudes of the heavenly bodies. If I mistake not, the earth's shadow is supposed by astronomers to be limited by lines drawn from opposite sides of the sun's circumference, touching opposite points of the earth's circumference, and continued until meeting in a point ; describing a cone, having the diameter of its base equal to the earth's diameter. Upon this principle, and *guessing* the sun to be at an amazing distance, (for it is all guess-work, see Dr. Halley's dissertation in Motte's

abreviation of the Philosophical Transactions, Vol. i. p. 243,) the diameter of the earth's shadow at the distance of the moon has been estimated at six to eight thousand miles; and this has served as a scale to measure the magnitude and distance of the moon, and it is very plausible;—but nature ought to be consulted; for, in many cases, she is too stubborn to be subjected to rules of optics and mathematics. For, in the one under consideration, no allowance is made for the very extensive effects of the solar light, which, in some instances, has been known to elevate the apparent places of the sun several degrees above his true place. *Barents*, the Dutch navigator, (alluded to by Mr. Ferguson in his astronomy) who wintered in Nova Zembla, latitude  $76^{\circ}$ , was astonished to see the sun above the horizon on the 24th of January, seventeen days sooner than calculation, from the altitude of the pole, led him to expect; the real place of the sun being, on that day, according to Kepler, about five degrees below the horizon. Mr. Leadbetter also mentions, (from Hodgson, Vol. ii. p. 274,) that on the 14th of June at midnight, near Forneo in the western Bothnia, latitude  $65^{\circ} 59'$ , the sun appeared elevated by the refraction, three to four diameters above his true place. In fact astronomers have no certain knowledge concerning the full extent of refraction, nor have they any means for obtaining it that can at all be depended upon. We know that as soon as the sun apparently rises a diameter above the horizon (whether refracted or real) the light thereof defines shadows, and the whole sensible horizon is illuminated, and would doubtless be so at that moment, were it a plane extending as far as the orbit of the moon. What dependance therefore can be placed upon the apparent dimensions of the earth's shadow in a lunar eclipse, for obtaining a true knowledge of the magnitude and distance of the moon?

I shall now state, from Mr. Brothers, some particulars concerning the natures, distances, and magnitudes of the sun and moon, and endeavour to corroborate his assertions by a few obvious remarks.

“ The sun (says he) is a body of bright created fire, and of considerably greater force than any we have produced by combustible matter: no length of time can wear it out,” (the Newtonians, however, are of opinion that it diminishes by the constant emission of

light and heat, and that it occasionally devours comets and other bodies to supply such diminution!) "nor the velocity of motion encrease it. But notwithstanding the force of this luminous fire, all the regions of air between it and the earth, to within a thousand miles of it, and five miles of the earth are so cold beyond any thing we know on this globe, as would vitrify the human frame to perfect solidity, if it could reach us—Providence having ordered it so in his wise disposition of all things, to qualify the sun's rays from scorching us with heat, even in this climate, the same as he has equally by provident care, ordained the cooling east winds in the West Indies, to make the heat of that climate endurable to man. Philosophers however account for all these things in a different way; but if they did not, and that in the most plausible manner, with the most elegant dress of language, their fame would lie dormant, and they could never live by writing on imaginary things."

What Mr. Brothers has asserted above, concerning the degree of cold at the distance of five miles above the earth, is, I think, sufficiently confirmed by the accounts of the French philosophers who ascended some elevated peaks of the Andes. These mountains, though situated in the torrid zone, have their tops perpetually covered with snow, and the highest parts of them so excessively cold, as to be unapproachable by man, without imminent danger of a deprivation of life.

"The moon is a clear chryselline body, round but rough on the surface, receiving entirely its light from the sun: any person that chuses to look, may see plainly with the naked eye the shades and rough surface of the moon, so he may likewise perceive shaded spots in the sun when it appears of a bright brassy colour: now if either luminary was placed beyond the proper distance assigned by their creator, to the extravagant distance assigned by philosophers, the human sight, notwithstanding their mighty bulk, could not see either, nor could the heat of the sun be felt in the least degree on any part of this earth. To be sure they have given size enough to these two bodies to make their hypothesis the more probable with respect to distance. But why should they father their system upon Providence as his work, when it goes to overthrow his own, and charge the Scripture, he has authenticated, with arrant falsehood?"



" Divine history tells us the globe is round, and that information being consonant to our sight and sense, we the more readily believe it: but it is navigation, and navigation alone with all its attendant experience—the many voyages of English and French, Portuguese, Spaniards and Dutch, that leave no longer any room for conjecture, but fill it up with solid proof, that plainly evinces to every reflecting man the world he lives in is, with respect to the aqueous part, most completely round." This seems to illustrate Job. xxvi. 10. *He hath described a SPHERE upon the face of the waters.*

" I have repeatedly viewed the planets through telescopes with as good eyes as ever man had in his head, and yet my judgment was the same as with the naked eye; for although the telescope swelled them larger, as it would in the same manner any objects upon earth beyond their due proportion and size, yet I freely own I could never swell them to the prodigious bulk, nor place them at the wonderful distance which philosophers have. The application of any mathematical rule to them is an idle farce, a real imposition, though not intended; but it answers the purpose of imaginary calculation the better to carry on a long chain of reasoning in support of a system, which it must be owned, few men, even the clergy, are able to contradict, or I believe have allowed themselves the leisure to reflect on with due consideration. It is like persuading people that a sparrow is as large as an eagle, or a mouse as big as a lion, and that a single mile is a hundred."

" The almighty God has said to me there is no earth but this we live on, no sun but the one we see plainly, and no people but ourselves; the earth is at rest, but the sun is in motion: the earth is larger than the sun, and the sun larger than the moon. The distance of the sun is the earth's circumference, and the moon's but half." (In another place he says, the diameter of the earth is 7200 miles; such I presume as we call geographical miles.) " The circumference of the sun is one-eighth of the earth's, and that of the moon one-twelfth: their size was regulated to that of the earth, because they were made solely for its use. Indeed our reason, if we make use of it, and our common experience, if we acknowledge it; unite in supporting the divine assertion. But it is so customary now to be

guided in philosophy, especially in this abstruse part of it, by others, that very few men will take the trouble to examine whether they have knowledge enough to guide themselves, or even a sufficiency to investigate the principles they subscribe to support. The system is learned as a divine truth, so that the error of the first master is carefully handed down to the last scholar, and why? Because all men reject the evidence of their own eyes, and the competent faculty of their own judgment, to adopt those of an elegant writer, a plausible reasoner, and an eminent mathematician, only because he is so, who knew no more how to calculate the diameters of the sun and moon, or their distances from the earth, than a child of three years old; but his eminence procured him the undoubted credit of knowing, and all people rejected the account of God, their own sight and sense, to believe his. I prove the wrong conceptions and system of Sir Isaac to every body that chuses to read, the arguments I advance, and God himself will soon seal the establishment of that proof in so firm a manner, that all men shall see it, but that all their united abilities shall never be able to overthrow it."

As I fully adopt the several particulars stated above, concerning size and distance, as strictly divine and true, I shall endeavour to give such reasons for my belief as I trust may convince even the sceptics, that what is said may possibly be right, although so different from what is taught in the Newtonian School.

These plain simple truths are indeed so widely different from their astronomical doctrines, that I am persuaded, whenever mankind shall receive them, the celebrated astronomers and eminent opticians of the present day, would, in some degree, be similarly affected, as were Demetrius and certain artists at Ephesus, by the plain preaching of St. Paul.

If the world should once be satisfied that the snow said to be seen upon the poles of the planet Mars, at the enormous distance of forty two millions of miles; and that the volcanoes and lightening said to be seen upon the moon at the distance of two hundred and forty thousand miles, exists only in the imaginations of the propa-

gators of such tales, the people would then cease to wonder, long telescopes (through which the owners fancy they at times see wondrous things which are invisible to others) would be shortened, and of course the authors would cease to publish such accounts for want of encouragement. If, instead of volcanoes, there could be seen old women smoking their pipes in the moon, we should then indeed have proof of its being an inhabited world, and, by parity of reasoning, might rationally infer the rest of the planets were such.

### THE DISTANCES, MAGNITUDES, &c. OF THE SUN AND MOON.

	MILES.
The diameter of the earth being 7,200 miles, the circumference of it will be.....	22,620
The diameter of the sun .....	900
The circumference of the sun .....	2,828
The distance of the sun's centre from the earth's centre	26,670
The diameter of the sun's orbit.....	53,340
The circumference of the sun's orbit.....	167,540
The sun's hourly velocity in his diurnal motion .....	6,980
The sun's hourly motion in his oblique annual course, about .....	19
The diameter of the moon.....	600
The circumference of the moon .....	1,885
The distance of the moon's centre from the earth's centre	15,210
The diameter of the moon's orbit .....	30,420
The circumference of the moon's orbit .....	95,566

In the circle PEOQ, (*Fig. 1*) which is described with a radius of 3,600 from a half inch scale of equal parts, PO represents the poles of the earth, and EQ the equator. CFJ is an arc of the meridian drawn from the centre A, with a radius of 26,670 miles, the distance of the sun. *w b e p* is another arc in the plane of the meridian described with a radius of 15,210 for the distance of the moon from the centre of the earth A.

### THE EARTH'S SHADOW IN A LUNAR ECLIPSE.

In a preceding page I have expressed a suspicion that the egregious errors of astronomers concerning distances and magnitudes were principally owing to a wrong notion of the real dimensions of the earth's shadow in a lunar eclipse. It is needless to add a more enlarged statement of their doctrines upon that head than I have there given, but shall endeavour to explain why the conical shadow of the earth, at the short distance I have ascribed to the moon, should be so small. I therefore explain myself upon that point in the following manner, leaving my theory to the free admission of probability,

That which we call the morning twilight, and which the ancients personified by the mythological goddess Aurora, generally appears first when the sun is about 18 or 20 degrees below the sensible horizon, and is doubtless caused by the solar rays falling upon the vapour which floats in the air at a considerable distance from the surface of the globe; by viewing it through a gross medium it at first appears faint, but, from an elevation above the cloudy regions it would doubtless appear with superior lustre.

From the arc of the meridian  $CFJ$ , at each side of the sun  $F$ , and at a distance of about 20 degrees, the lines  $kry$ , and  $ury$ , are drawn touching the circumference of the earth at the points  $r$ ,  $r$ , near the poles, and meeting at  $y$  the vertex of the cone; these lines cut the arc  $qhq$  which is drawn in the plane of the meridian, at about the distance of a diameter from the moon  $h$ , and mark the limits of the earth's shadow  $r, r, y$ , caused by the light as above-mentioned; for being seen upon all points of the line  $rrr$  it would also appear at the vertex of the cone  $y$  as a luminous ring surrounding the globe, but far surpassing in brightness its appearance to us, owing, as I have said to its being seen through a gross medium of air loaded with vapourous exhalations. I judge some idea may be formed of its appearance at the moon, from the refulgence which is reflected about sun-rising or sun-setting, from the margins of dark clouds whose bodies are too dense for the rays of light to penetrate through, but whose margins are tinged with a splendor inferior only to the body of the sun.

I conclude therefore that this luminous ring, caused by the great refraction I have already adverted to, is quite sufficient to define the shadow of the earth as it appears in a lunar eclipse.

It is observed by astronomers, that the moon does not always appear with the same brightness, at times when the atmosphere is equally clear, and they have attempted to explain the reason of it by different conjectures. From what has been said concerning refraction, this I think may be easily accounted for, by considering, that from the time the moon arrives within fifteen or twenty degrees of the opposition, or full, until she reaches the same distance past it, represented by the arc  $q h q$ , she receives only the refracted light of the sun, but as soon as she moves past the distance of the limit  $q$ , she falls under his direct rays, and therefore becomes divested of that dim or pale appearance she is observed to have about the full.

Some philosophers, says an author, have been so taken with the beauty of the brightest places observed in the moon's disk, that they have imagined them to be rocks of diamonds, and others have compared them to precious stones. Her appearance, though rough, is certainly very different from the surface of the earth, and seems to have nothing in it to justify the notion that the moon is an inhabited world: but her face fully justifies the account Mr. Brothers gives of her composition, namely that she is a chrySTALLINE substance, somewhat like frozen ice: and this moreover seems corroborated by the similarity of appearance she has to white clouds seen in the same direction when she is above the horizon, and visible in the day-time.

#### ON THE PARALLACTIC ANGLE AND REFRACTION,

It will perhaps be objected, that, on the supposition of the sun and moon being so very near the earth, as has been stated, the greatness of the parallax angle, from the effect it would have upon all observations upon those luminaries, would immediately prove, that they performed their revolutions in orbits, comparatively very near to us.

I will examine, for example, the effect so great a parallactic angle would have upon an observation made upon the sun, at London, when he arrives in the equinoctial.

From the point E on the equator towards O the north pole is set off fifty one degrees, thirty one minutes, for the latitude of an observer at London, or the point N, and through N from the centre A is drawn a line ANI, which is crossed at right angles, in the point N, by the line KT which represents the sensible horizon of an observer at London, I his zenith, and KIT an arc of the meridian, numbered at every ten degrees.

From the point N, or latitude  $51^{\circ} 31'$ , the sun, when he enters the equinoctial points, should be seen at an altitude of  $38^{\circ} 29'$ , or, thereabouts, when crossing the meridian; but I find this by no means agrees with the scheme I have drawn, for, a line NG drawn cutting the quadrant KIN at  $38^{\circ} 29'$  will not reach the sun at F in the equinoctial, but run parallel to EF, the angle EAN being  $51^{\circ} 31'$  and, ANG  $128^{\circ} 29'$ , which added together make  $180^{\circ}$ . I therefore conclude from this, that the sun is not seen in his true place, or that  $51^{\circ} 31'$  is not the true latitude of London, and I proceed to ascertain what may be the difference.

As Radius .....	10.
Is to AN, 3600 miles .....	3.556302
So is the angle c AN, $51^{\circ} 31'$ .....	9.893644
To c N, 2818 miles .....	3.449946
As Radius .....	10.
Is to AN, 3600, .....	3.556302
So is the angle c NA $38^{\circ} 29'$ .....	9.793990
To A c, 2240 miles .....	3.350292
Having the side c N, 2818 miles, and FA, 26,670—A c, 2240	
=24,430; the hypotenuse FN is found by taking $\sqrt{c N^2 + c F^2}$ ,	
and is 24,591 miles; whence the angle c FN is thus found;	
As FN, 24,591 .....	4.390775
Is to Radius .....	10.
So is c N, 2818 .....	3.449941
To the angle c FN, $6.35$ .....	9.059166

This angle  $cFN$  is equal to the angle  $FNG$ , and therefore, admitting the sun to be at the short distance of only 26,670 miles from the centre of the earth, his true place is depressed  $6^{\circ} 35'$  below his apparent place, or the true latitude of London is less than what it is above stated to be, namely  $51^{\circ} 31'$  less  $6^{\circ} 4'$  ( $31'$  being deducted from  $6^{\circ} 35'$  for the difference between the station  $N$  and the centre of the earth  $A$ ) or  $45^{\circ} 27'$ , the point  $D$ , from whence, according to (*Fig. 1.*) the sun when crossing the meridian on his arrival in the equinoctial is seen at an altitude of  $38^{\circ} 29'$ , for the right line  $DF$ , continued, cuts the arc of the quadrant  $BXZ$  at  $38^{\circ} 29'$ . Therefore if the sun's distance be as above stated, and admitting that he appears direct in his true place at the equinoxes, it must be the true latitude of  $45^{\circ} 27'$ , only from which he can be seen at the altitude of  $38^{\circ} 29'$ .

But I admit that  $51^{\circ} 31'$  is the true latitude of London, or nearly so, and also, that, generally speaking, the latitudes of most parts of the habitable globe may be had by the usual methods of observation upon the sun and polar star: but then something must be found to counteract the effects of so great a parallax angle, and this I conceive is effectually done by the refraction of the solar light; for, I lay it down as a positive principle, that the refraction is, in all cases, at least equal to the parallax, and in cases of a long absence of the sun such as I have before mentioned, it is considerably more. It is this surprising agent in nature, that in all ages, from Hipparchus down to Sir Isaac Newton, has baffled every attempt, and set at defiance every method put in practice by astronomers, in their endeavours to measure the distances of the heavenly bodies. That the refraction of the sun and moon, when in, or a little above, the horizon, is at least equal to the semidiameter of the globe, is proved by both having been frequently seen above the horizon, in temperate climates, at the moment when the latter was totally eclipsed.

In winter the moon's orbit appears to be dilated or enlarged, which is doubtless owing to her increased elevation by the agency of refraction, because of the greater degree of cold by the sun's absence in the southern part of the ecliptic; and not, as astronomers assert, by the pressure of gravity from the sun.

The phenomenon of refraction is well known to astronomers, but then they admit but a very small portion of its extensive effects: were they to admit it as it really is it would quite derange the system of gravity and attraction, and completely overthrow all their curious theories and profound calculations concerning the distances of the sun, &c.

The method made use of by astronomers to discover the quantity of the horizontal refractions, can lead to no certain result, for it pre-supposes the polar star to have no sensible elevation above its true place, which they have no way of proving. I need not enlarge upon it.

The line, N \*, cuts the quadrant, ITN, at  $51^{\circ} 31'$ , the apparent elevation of the pole at London, by which the pole, \*, seems elevated above its true place, J, about four degrees. Travelling in that direction, were it possible to proceed to the north pole, I judge, agreeably to what has been advanced, that the quantity of refraction represented by the space \* J would insensibly continue to decrease, until J became the zenith of the observer, when that point would have no refraction, but be seen in its true place. The same inference might be drawn concerning the sun, &c.

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#### INCLINATION OF THE SUN'S ORBIT TO THE EQUATOR, OR, OBLIQUITY OF THE ECLIPTIC.

It is well known to astronomers, that, in some respects, the observations made by the ancients upon the places of the heavenly bodies, differ considerably from those of the moderns: and also that the observations of modern astronomers, situated upon different points of the globe, have, in many instances, by no means corresponded with each other. The differences found in modern observations, when compared with those of ancient times, are however, generally, though I am of opinion, improperly established in favor of the moderns to the disparagement of the ancients.



I believe, by a due consideration of the great proportion the semi-diameter of the earth bears to the distances of the planets, and the extensive effects of the refraction of light, many of the differences and appearances may be accounted for more rationally than by the curious hypotheses different authors have deduced from the pretended laws of motion and gravity. I shall, for example, notice the supposed diminution of the obliquity of the ecliptic.

The Newtonian theorists assert, that the action of the sun and moon upon the more elevated parts of the earth about the equator, (already noticed) gradually pulls it to a nearer coincidence with the plane of the ecliptic; from which cause the gradual diminution amounts to about a minute of a degree annually, and, as evidence of the fact, they produce the testimony of Ptolemy, who, by several years' observation, found the angle of obliquity to be  $23^{\circ} 51'$ , whereas modern astronomers make it to be only  $23^{\circ} 28'$ , or  $23^{\circ} 29'$ .

Now it appears to me, that the most natural way of reconciling this difference, will be to suppose, that it is caused by the latter observers being situated more northerly than the former, than preposterously to suppose there is an instability in the order established by providence for the regular and perpetual change of seasons. To explain my reasons for the former supposition, I submit the following investigation to the judgment of the unprejudiced reader.

Let the relative situations of London and Alexandria to the sun in the summer solstice be examined.

The point S, in the semicircle CWFSJ, represents the true place of the sun when passing the meridian on his entrance into the summer solstice, at a declination from the equinoctial F of about  $23\frac{1}{2}^{\circ}$ . His apparent place, *a*, to which he is elevated by the refraction, is distant from his true place, S,  $4^{\circ} 8'$ , which is equal to the angle of parallax, ascertained in the same manner as the angle *c* FN. In this situation the sun is seen from the point N, (latitude  $51^{\circ} 31'$ ) at an altitude of  $61^{\circ} 57'$ , for the line N *a* cuts the quadrant KIN at  $61^{\circ} 57'$ .

The point  $d$  marks the apparent place of the sun to an observer at  $x$ , the latitude of Alexandria, where Ptolemy made his observations; his apparent place, as seen from that station, (allowing the refraction to be equal to the parallax,) is found to be elevated above his true place  $1^{\circ} 9'$ , namely, the arc  $Sd$ .

The observed latitude of London .....	$51^{\circ} 31'$
That of Alexandria.....	$31 \quad 11$
Difference of latitude .....	$20 \quad 19$

By inspection of the figure, it is evident that the point  $x$  (or Alexandria) is considerably more elevated towards  $d$ , than the point  $N$  (or London) towards  $a$ . The more elevated towards the sun, the greater will appear, to an observer, the angle or arc of the meridian subtended by the extreme points of his declination north and south. Therefore, the distance of  $x$ , the latitude of Alexandria, being shorter than the distance of  $N$ , the latitude of London, it is demonstrable that the angle of obliquity or inclination of the sun's orbit to the plane of the equinoctial, will appear greater at the former than the latter place.

In order to discover the difference, it will be necessary to ascertain the distances of these places from the point in which the sun appears to each, respectively, when in the summer solstice.

From the latitude of London.....  $51^{\circ} 31'$

Deduct the sun's apparent declination when

in the summer solstice .....  $23^{\circ} 28'$

Angle of elevation by refraction  $4^{\circ} 8'$  at  $N$ ; }  $3 \quad 39$

reduced to the centre of the earth  $A$  .... }  $27 \quad 7$

Leaves the angle  $NAm$ , or  $NAa$ .....  $24 \quad 24$

As Radius :  $NA$ , 3600 ::  $NA'm$ ,  $24^{\circ} 24'$  :  $mN$ , 1487.

The angle  $ANm$  is  $65^{\circ} 36'$  because the angle  $NAm$  is  $24^{\circ} 24'$

As Radius :  $NA$ , 3600 ::  $ANm$ ,  $65^{\circ} 36'$  :  $Am$ , 3278.

Then to find  $Na$ , or the distance of London from the sun's apparent place, we have  $Aa$ ,  $26670 - 3278 = ma$ , 23392; and  $mN = 1487$ ; wherefore,  $\sqrt{ma, 23392^2 + mN, 1487^2} = 23439$  miles, the distance of London.

In like manner the distance of Alexandria, in latitude  $31^{\circ} 11'$ , is found to be 23095 miles from the sun's apparent place when crossing the meridian in the summer solstice.

From the latitude of Alexandria .....  $31^{\circ} 11'$

Deduct the sun's greatest declination north, }  $23^{\circ} 51'$   
as it appeared to Ptolemy ..... }

Also the quantity of refraction, (equal to }  $1^{\circ} 9'$ , or the arc  $Sd$ , which }  $1^{\circ} 0'$   
the parallax) ..... }  
reduced to the centre of the earth, is.... }

$24^{\circ} 51'$

The difference is the angle  $xAn$  .....  $6^{\circ} 20'$

And its complement to a right angle is the angle  $Axn$   $83^{\circ} 40'$

As radius :  $Ax$ , 3600 ::  $xAn$ ,  $6^{\circ} 20'$  :  $xn$ , 397 miles.

As radius :  $Ax$ , 3600 ::  $Axn$ ,  $83^{\circ} 40'$  :  $Am$ , 3578 miles.

$\sqrt{Ax^2 - Am^2 + xn^2} = xd$ , 23095 miles, the distance of Alexandria from the sun when in the summer solstice in his apparent place.

As bodies or spaces, comprehended between any given points, are seen under angles inversely proportionate to the distances at which they are viewed, so, as I have before observed, that arc of the meridian, comprehending the sun's greatest declination north, will appear larger at Alexandria than at London, because he is nearer to the former than the latter place. The obliquity of the ecliptic appears at London to be  $23^{\circ} 28'$  or  $23^{\circ} 29'$ , perhaps the latter is nearest the truth, being what Mr. Flamsteed and his contemporaries (who had no idea of the system of gravity) stated it to be; I therefore adopt it, and say, As 23095, the distance of Alexandria : is to 23439, the distance of London :: so is  $23^{\circ} 29'$  the apparent obliquity at the latter place : to  $23^{\circ} 50'$  the apparent obliquity at the former place. This comes within one minute of Ptolemy's observation; and if some small allowance be made for a diminution of the refraction by the more rarified air of Egypt, or for the more direct view of the angle in that situation, it is probably as near as calculation can well be brought to agree with observation.

The result of this investigation is, I think, no small proof of the truth of three things here treated upon; namely, the distance of the sun as I have stated it; the refraction of light equal to the parallax; and the stability of the sun's course as originally appointed by the creator.

To prove that the obliquity of the ecliptic does not experience the diminution asserted by the Newtonian theorists, it need only be noticed, that, Eratosthenes of Cyrene, with other astronomers about his time, observed the quantity of the angle of obliquity to be the same as Ptolemy found it more than 400 years afterwards; whereas, according to the modern doctrine it ought to have been about 5' less in the time the latter lived. It may be further observed, that John Werner, a German, and Dominic Maria, an Italian, both astronomers, state it to be the same, more than 300 years ago, as it is found at the present time in these northern latitudes, namely, about  $23^{\circ} 28'$  or  $23^{\circ} 29'$ .

In this particular, as well as many others, the theory of gravitation directly contradicts the express declaration of God immediately after the flood. The Newtonians declare that, after a certain period of time, the planes of the ecliptic and equator will coincide with each other; consequently there would then be an end of the vicissitudes of seasons; there would no longer be any distinction of spring, summer, autumn, or winter. The positive word of God, however, as recorded in the eighth chapter of Genesis, intimates with sufficient clearness, that no such changes shall ever take place.

“ While the earth remaineth, seed time and harvest, and cold and heat, and summer and winter, and day and night shall not cease.”

A FURTHER CONFIRMATION OF THE DIVINE SYSTEM IS OBTAINED FROM THE DIFFERENCE OF THE MOON'S GREATEST AND LEAST APPARENT SEMIDIAMETER WHEN IN THE SYZYGIES, OR THOSE POINTS OF HER ORBIT IN WHICH SHE IS AT THE TIME OF FULL AND CHANGE.

According to Ricciolus, the apparent semidiameter of the moon in the syzygies, when least, is 14', and, when greatest, 16', 45". It is greatest when nearest the zenith of the observer. The moon when crossing the meridian is nearest to, and most distant from, the zenith, when she is in the quadratures or 90° from the points where her orbit intersects the sun's orbit. Her greatest declination north and south from the equinoctial  $\kappa$ , represented by the points  $b$  and  $e$ , is then about 28° 46'. Let her distance from the latitude of London, or  $N$ , to those points respectively, be ascertained and compared with the dimensions of her semidiameter above stated.

The point  $b$ , which is below the sensible horizon to an observer at London, shews the moon's true place, and the point  $f$  her apparent place when at the limit of her greatest declination south. Her true place when at her greatest declination north is represented by the point  $e$ , and the place to which she is raised by refraction, or her apparent place, is the point  $g$ . The refraction in both cases is equal to the angle of parallax, according to the principle before laid down, The quantity of refraction, when the moon is at  $b$ , is 13° 30', or the arc  $bf$ ; and when she is at  $e$  the refraction is 5° 15', or the arc  $eg$ .

Having, in the triangle  $ANf$ , the angle  $NAf$ , 66° 47'; the side  $AN$ , 3600 miles; and the side  $Af$ , 15210 miles, the other needful particulars are easily found.

As  $Af + AN$ , 18810 :  $Af - AN$ , 11610 :: tangent  $\frac{1}{2} ANf + AfN$ , 56° 36' : tangent  $\frac{1}{2} ANf - AfN$ , 43° 7'. Therefore the two last terms, added together, gives 99° 43' for the quantity of the angle  $ANf$ . Then to find the side  $Nf$ , the distance of the moon, the analogy will be, as  $ANf$ , 99° 43' :  $Af$ , 15210 ::  $NAf$ , 66° 47' :  $Nf$ , 14182 miles.

After the same manner her distance from London is found to be 11826 miles when at  $g$ , her utmost northern limit, for we have the lengths of the sides as before; viz.  $AN$ , 3600; and  $Ag$ , 15210. The angles are  $NAg$ , 17° 30';  $ANG$ , 157° 15'; and  $AgN$ , 5° 15'. It is unnecessary to enter into the particulars of the calculation.

Having ascertained the distances of the moon, as was proposed, it remains to shew the effect the difference ought to have upon her apparent magnitude when in the said situations. It will be inversely as the distance; therefore,

As 14182 miles, the moon's greatest distance :

Is to 11826, her least distance ::

So is, 16' 45", her greatest apparent semidiameter :

To 13' 58", her least apparent semidiameter.

This agrees nearly enough with observation, for I presume no observer will pretend to come within two seconds of a degree of the truth.

There is nothing in the distances ascribed by the solar system to the moon, nor in the pretended excentricity of her orbit, that will account for a difference at times of *one-sixth* in her apparent diameter, nor indeed of more than a few seconds: but, the investigation here given agrees with the observations of astronomers, at the same time that it affords a confirmation of the moon's distance being no more than 15210 miles from the centre of the earth.

CONCERNING THE APPEARANCES WHICH HAVE INDUCED ASTRONOMERS TO ASSERT THAT THE EARTH MOVES IN AN ELLIPTICAL ORBIT, &c.

It is observed that the motion of the sun seems to be accelerated as he moves from the summer to the winter solstice: and from this appearance it is inferred that he is more distant from the earth in the former than in the latter situation, and also that the earth revolves in an elliptical orbit, the sun being in one of its focuses.

The other appearance, from which the astronomers infer these strange notions, is that of the sun seeming to be of different sizes at different seasons of the year; but, as they allow this to be too precarious to settle the point, I shall not further notice it.

Astronomers would never have held these opinions could they have viewed the sun in his course from the centre of the globe, from which point he would constantly be seen under the same angle of magnitude, and having the same uniform velocity: but it is evident, at the moderate distance at which he is placed, compared with Newtonian distances, that the earth's semidiameter must have a very sensible effect upon all observations made upon the sun and moon.

This will perhaps manifestly appear by a reference to (*Fig. 1.*) in which N represents the station of an observer at London, where the sun, when in the winter solstice in his apparent place at *t*, is seen at an altitude of  $15^{\circ} 1'$ . The parallax angle is then about  $7^{\circ} 29'$ , that is to say, the angle A *t* N.

When the sun arrives in the summer solstice, he appears at an altitude of  $61^{\circ} 57'$ , and makes an angle of parallax, A *a* N, of about  $3^{\circ} 29'$ .

From a consideration of these angles, I am of opinion the cause of the sun's seeming unequable motion is manifest. The apparent increase or decrease in his velocity will in all cases be reciprocally as the increase or decrease of the angle made at different seasons of the year by the centre of the earth, the sun, and the observer. In winter the sun, it is said, appears to move quickest—the said angle is then largest; in summer he appears to move slower when the angle is least. This matter is still further evident by considering that any given angle comprehends a smaller portion of the oblique plane of the ecliptic in the winter, represented by the line *t* A, because the view of it from N is more direct than is the view of A *a* from the same station when the sun is in the summer solstice; for N*a* is nearer to a coincidence with A *a*, than with A *t*.

From the same oblique view of the sun, during his annual course, he has appeared to astronomers to be about seven days, nineteen hours, and ten minutes longer, in the northern than in the southern half of the ecliptic. I find, at the distance I make him

to be; that the distance of the observer from the centre of the earth, or half the diameter, makes an angle, with the sun of a little more than  $7^{\circ} 41'$ ; which reduced to time is about seven days, nineteen hours, ten minutes; whether this directly explains the point I will not say; I leave a further investigation of it to others, not having myself, at present, sufficient leisure from other concerns more immediately urgent. And moreover, being resident in a country place, I have neither the necessary books nor instruments to assist me in such investigations. I am, however, fully persuaded that the candid examiner will find, in the observations I have made, the true causes of those appearances which induced Kepler, Newton, and others, to broach and establish the extraordinary notion, that the earth moved in an oval, or elliptical orbit.

The seeming irregularities in the moon's motion, may, I have no doubt, be traced to similar causes, and, by an attentive consideration, be more rationally explained, than by the theories built upon any ideas of the sun's attraction.

The writers in favor of the solar system having, by their guessing, placed the heavenly bodies so very far beyond the reach of either instruments or calculation, no change of station on the surface of the earth could be supposed to have any sensible effect upon their apparent motions in their respective orbits. But on the supposition that they are, comparatively, at a small distance from us, (which I trust I have sufficiently proved) I am fully of opinion that a due consideration of the refraction and parallax, added to a tolerably correct knowledge of their several motions, (I am speaking of the planets) with leisure, proper instruments, patient attention, and a laudable zeal for the improvement of useful science, will overcome all such difficulties, the solution whereof can be really necessary or useful to mankind.



There are several other points upon which my avocations in life will not at present permit me to proceed. Thus far however, I have conceived it to be my duty to give a testimony to that which possesses a full internal evidence of divine science. To vindicate the truth is my object; and, in this feeble attempt, I trust, I shall not be found to have added materially to that almost universal cloud by which its fair form is veiled; I believe I have built upon a true foundation, and I hope I have built truly; were I apprehensive of the contrary, these pages should never be brought forth to the light. For, a time approacheth when divine, primitive science shall be had in repute—when the chaff shall be winnowed from amongst the wheat, and the simple-hearted be no longer led astray, and distracted by the loads of *learned* contradiction and falsehood, which are unceasingly heaped upon the world.

It may appear, to many, not only folly, but also presumption, in me, obscurely situated in life as I am, to attempt to defend the subject in question, or to dispute the infallibility of the solar system, established by so many (reputedly) illustrious geniuses, with Sir Isaac Newton at their head—a fabric consecrated by the almost unanimous adoption of all civilized nations, celebrated by poets and historians, and covered with the ivy of ages! Its supporters have long since consigned it to the trumpet of immortal fame. Who then will believe that this reputed monument of the most sublime and consummate human sagacity shall ever be exploded? It cannot be reasonably expected that, in the present state of human knowledge, many will believe this, after having been so long taught by its advocates, that it is as imperishable as the frame of nature itself. Such vain and presumptuous assertions will not however save it; it will most assuredly be disposed of with as little ceremony as its founders used in disposing of the systems of their predecessors. It will experience the fate of all those speculative fallies of fertile imaginations, which have, from time to time, been imposed upon the world under the semblance of truth by men, greedy after praise, attempting to overstep the boundaries of that sphere of useful intelligence allotted to them by their creator. By such arts many have for a time become elevated and dazzling like meteors, and have successively struck the world with wonder and awe—the impressions of the former being in

a manner effaced by a contemplation of the present; but, (like those transient lights,) of such visionaries, after a lapse of time, little more is recorded concerning them than that they once existed. The reason of this is obvious; their works being built upon the sandy foundation of mere conjecture, and being calculated to amuse rather than instruct a fickle world, were destined to give place to the first *new* theory that should appear recommended by conceptions of equal ingenuity, to serve as a fresh supply for idle curiosity. On the contrary, the revealed wisdom of God—the genuine productions of TRUTH, are firm as his throne, and lasting as eternity: like the sun in the firmament which is at times obscured by passing clouds, it is the lot of divine truth to be clouded by the sinister devices of men; or the beneficial influence of its vivifying rays to be intercepted by vain philosophy; but in itself it permanently shines uninjured, and will so continue when the mists of falsehood shall be blown out of the world.

Alas! that mankind should lightly reject the simple, though solid, sublime and comprehensive science of their creator, and from time to time adopt the discordant notions of wild theoretical speculators.

In addition to the opinions and doctrines of Kepler, Newton, Halley, &c. which I have already noticed, I shall state those of a few more philosophers; and then introduce the divine account of the creation—leaving the candid reader to form his own conclusions.

Zenophanes, it is said, taught, that “the universe, as to its nature and substance, is one; that it consists of matter, and the divine energy with which that matter is impregnated; and that this energy was to be considered as a quality in matter which gives existence to the universe. There is neither generation nor corruption in the nature of things. He also supposed there were many worlds, infinite and immutable; that the sun was a cloud of fire; and that there were different suns for the different climates.”

According to Leucippus, Democritus, and Epicurus, among the ancients, and Maganus, Gassendi, and others among the moderns,

"there are no other beings except atoms. These being peculiarly endowed with solidity, they held to be infinite and destitute of all qualities, except weight, fire, and figure. However, being whirled by a rapid motion, the parts of one stick into the corresponding cavities of the other, and thus unite into masses. All the differences of things, and in particular all their qualities, arise entirely from the figure and arrangement of these atoms." (Here was an idea for the Newtonian theory of light and colors.) "These elements (the atoms) endowed with all possible kinds of figures and detached from the total mass of infinity, are carried into the void, where they unite and form a vortex, the agitations of which, cause the corpuscles to approach in such a manner as that things of the same kind mutually tend to, and unite with each other, assume a figure which when covered with a skin become bodies, the totality of which forms a world like ours." "From hence it was inferred that the world had no necessity of being created by divine power, and that providence is no way concerned in its regulation, since the fortuitous concurrence of nature is sufficient to answer all those purposes!"

Diogenes of Apollonia, with others of his time, held "the air to be the first principle of things, but that a divine power was necessary to animate its matter into motion. He supposed that there existed an infinity of worlds, that the earth was of an oval figure, and that the stars were exhalations formed by the perspiration of the universe;"

Archilaus, the disciple of Anaxagoras, taught that "the earth was placed in the centre of the universe and had no motion. That it originally resembled a wet marsh, but was afterwards dried up, and its figure resembled that of an egg. Animals were produced from the heat of the earth, and even men were formed in the same manner!"

Descartes, the famous French philosopher, and his followers, endeavoured to shew that the universe was formed by certain mechanical principles, and that by such principles it may be eternally preserved. The sun according to them "is supposed to be placed in the centre of a vast whirlpool of subtile matter, which extends to the utmost limits of the system; and the planets, being plunged

into such parts of this vortex as are equal in density with themselves, are continually dragged along with it and carried round their several orbits by its constant circulation. Those planets which have satellites, are likewise the centres of other smaller whirlpools which swim in the great one; and the bodies that are placed in them are driven round their primaries in the same manner as those primaries are driven round the sun!"

Such is the wisdom of man; Who can peruse the specimens I have quoted without setting a seal to the truth of that scripture which declares "the wisdom of man to be foolishness with God?" Most assuredly "the wisdom of these wise men shall perish;" for, alas! they have, according to the metaphorical language of the Bible, "committed two evils, they have forsaken the fountain of living waters, and have hewn out to themselves cisterns, broken cisterns that can hold no water." That such has been their folly, will I trust, appear evident to every one possessing a sound understanding, who will, with candour, compare the divine account of the creation, with the most celebrated creations of the human imagination: And the better to enable the reader to do so, I shall here insert God's account of the creation, as restored to its original form by Mr. Brothers.

## GENESIS,

### CHAPTER THE FIRST.

1. In the beginning God created the water, the heaven, and the earth; and the earth was without form, there was none, all was a void space of darkness.

2. And God said, Let there be water, and there was water, and the spirit of God moved through the depth of the water.

3. And God said, Let there be light, and there was light, and God saw that the light was good, and God divided the light from the darkness.

4. And God called the light day, and the darkness he called night: and the morning and the evening were the first day.

5. And God said, \* Let there be a firmament in the midst of the water, and let it divide the water in two parts.

6. And God made the firmament which divided the water under the firmament from the water above the firmament, and it was so : and God called the firmament heaven ; and the morning and the evening were the second day.

7. And God said, Let the water under the heaven be gathered round together to one place, and let the dry land appear ; and it was so.

8. And God called the dry land earth, and the gathering round together of the water he called the sea, and God saw they were good.

9. And God said, Let the earth bring forth grass, the herb yielding seed, the fruit tree yielding fruit after its kind, whose seed is in itself upon the earth ; and it was so.

10. And the earth brought forth grass, the herb yielding seed after its kind, and the fruit tree yielding fruit whose seed was in itself after its kind : and God saw they were good : and the morning and the evening were the third day.

11. And God said, Let there be lights in the firmament (the heaven) to divide the day from the night, and let them be for signs, and for seasons, and for days, and for years, and let them be for lights in the firmament to give light on the earth ; and it was so.

12. And God made two great lights, the greater light to rule the day, and the lesser light to rule the night ; he made the stars also.

\* What is recorded in the 11th verse of the 7th chapter ; and the and verse of the 8th chapter, concerning the commencement and remission of the flux of waters, which were appointed to cover the surface of the globe at the time of the universal deluge, is quite agreeable to the account given here, and in the following verses, of the division and disposal of them when created ; that is to say, partly above the firmament or sphere of the heavens ; and partly below, in and about the great globe of this earth. There is, therefore, no impropriety in the account transmitted down from Noah, notwithstanding it has been a darling theme for the ridicule of the sceptics : the words are, " and the same day were all the fountains of the great deep broken up, and the windows of heaven were opened," &c. "*Windows*," namely, *issues*, or *passages*, made by almighty power for the waters above the concave sphere of the heavens to issue forth, and assist the waters in, and upon, the earth, the more completely to overthrow it.

13. And God set them in the firmament to give light on the earth, and to rule over the day, and over the night, and to divide the light from the darkness; and God saw they were good: and the morning and the evening were the fourth day.

14. And God said, Let the water bring forth abundantly the moving creature that has life, and fowl that may fly above the earth in the open firmament, the heaven.

15. And God created great whales, and every living creature that moves, which the water brought forth abundantly after their kind, and every winged fowl after his kind, and God saw they were good.

16. And God blessed them, saying, Be fruitful and multiply, and fill the water, and let fowl multiply on the earth; and the morning and the evening were the fifth day.

17. And God said, Let the earth bring forth the living creature after his kind, and cattle, and creeping thing, and every beast of the earth after his kind; and it was so.

18. And God made the beast of the earth after his kind, and cattle after their kind, and every creeping thing that creeps on the earth after his kind, and God saw they were good.

19. And God said, Let us make man in our image, after our likeness, and let him have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creeps on the earth.

20. So God created man in his own image, in the image of God's own self he created him, male and female he created them.

21. And God blessed them, and God said to them, Be fruitful and multiply, and fill the earth, and possess it, and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moves on the earth.

22. And God said, Behold, I have given you every herb bearing seed which is on the face of all the earth, and every tree, and every fruit tree yielding fruit, to you they are given for use and food.

23. And to every beast of the earth, and to every fowl of the air, and to every creeping thing with life that creeps on the earth, I have given every green herb for food; and it was so.

24. And God saw every thing that he had made, and behold, the whole was very good; and the morning and the evening were the sixth day.

## CHAPTER II.

1. Thus the water, the heaven, and the earth, with all things they contain, were finished.

2. And on the sixth day, God ended his works that he had made, and on the seventh day he rested from all his works that he had made.

3. Therefore God blessed the seventh day, and sanctified it, because that on it he rested from all his works, the works which he had created and made.

This account, like all other divine productions, is as remarkable for a beautiful simplicity, as it is for being comprehensive and sublime. How different from those philosophical reveries concerning worlds being formed by a fortuitous concurrence of atoms : or by mechanical principles of whirling vortices : or by attraction and gravity in the *laboratories* of the universe ! Here is an agent presented to the mind's view, all-sufficient to create ; and here is a system worthy of him—a system either directly or indirectly authenticated by all the scripture writers who succeeded Moses, down to the period of our Lord's appearance in the form of Jesus Christ. And he abundantly confirmed the veracity of it, not only by his public testimonies but also by his acts : by his testimonies, in frequently referring to the authority of the scriptures from Genesis down to Malachi ; and by his acts in the miracles he wrought. For, as by his word, all created things appeared in ORDERLY succession ; so also by his word, the lepers were cleansed, the sick were healed, the lame walked, the blind received their sight, and the dead were restored to life !

Several learned men, desirous of either shewing their ingenuity or their zeal in defence of the sacred writings, as well as of the solar or Newtonian system, have laboured hard to reconcile them together, by putting such constructions upon Hebrew words and phrases, as in strict propriety were inadmissible. So that instead of making manifest the truth, they have, by twisting and perverting things simple and obvious, multiplied doubts, and greatly promoted that spirit of scepticism which now so universally prevails.

Other philosophers, on the contrary, have endeavoured to silence the scruples of the multitude by assuring them, that the descriptive language of the sacred writings was purposely adapted to the appearance and not to the real nature of things; to the prejudices and not to the rational powers of the people; and that the scriptures were intended to teach them goodness, not knowledge. From all which it might be inferred, that the intellectual capacities of men were originally formed defective; or, that the creator was unable, or rather unwilling, to clothe his truth in such language as might be comprehensible to his creatures, lest it should impede their progress in goodness! Whatever are, or may have been, the serious opinions of such philosophers concerning these things, or however they may have been characterized, in the estimation of their patrons and admirers, for diffidence and modesty; it seems sufficiently manifest, that notwithstanding their pretended respect for the biblical writings, they have not hesitated slyly, to dispose of the wheat and gold of the sanctuary, as far as in their power, in order to make room for their heaps of chaff, sand, and rubbish, to elevate *themselves* upon.

A philosopher of this school, lately delivering a public lecture in this neighbourhood, upon the principles of the solar system, when he came to treat upon the famous doctrine of centrifugal motion, either apprehensive that it did not well digest with part of the company, or being desirous that none should go away ignorant of the wonderful *convenience* and *simplicity* of such a supposed motion of the globe before the sun, like unto a goose upon a spit turning before a kitchen fire, (for that was the figure he made use of,) to render it the more impressive, he reversed the matter, by repeating the story of a *contriver* who was said to have caused the fire to circulate about the goose! What effect this *elegant* contrast of the matter had upon the conviction of the audience, it is not for me to say; but I am of opinion the inventor of it might have picked up a better thing by the light of his millions of suns. It is, however, a little shaft levelled at the divine system and its *vulgar* supporters; they, notwithstanding, will continue to believe that it is as truly philosophical to believe, that the glorious lamp of day circulates about our *earthly house*, dispensing its light and vivifying influence, as that the *house* and its



inhabitants should be whirled about the lamp in order to receive the same benefits.

Since the modern astronomers, with all the parade of their mathematics, aided by the boasted superiority of their instruments over those of the ancients, cannot prove the immense distances, nor the enormous magnitudes which they have so confidently and so pompously ascribed to the sun, moon, stars and comets; and since their telescopes, instead of discovering any of them to be inhabited worlds,\* have only enabled them to multiply vague, puerile conjectures, instead of useful or well-founded facts; I would recommend my friends and countrymen at once to reject their observed theories, and to adopt the plain firm foundation of the word of God to build upon. As the heavenly bodies are beyond the reach of our examination, let us be satisfied with the beneficial and important uses they were plainly and expressly created for, namely, "To divide the day from the night, and for signs, and for seasons, and for days, and for years, and to give light upon the earth." This is part of the plain unadorned truth of God, and as it is quite as agreeable to our senses and reason, as any wild fancies propagated upon the subject by Pythagoras, or any other Greek or English philosopher, why not adopt it? As christians, professing to believe in the lively oracles of God, consistency requires us to do so, and not by our foolish reasonings, to sap the very foundation of that faith which ought to be the rule of our conduct, and the ornament of our lives. If we adopt God's account, it is true we shall not have, in our lectures and writings

\* Since the commencement of the present century, the discovery of two additional planets has been announced to the public; one of them is named *Pallas* and the other *Ceres*. These with the *Georgium Sidus*, are now incorporated with the solar system without disturbing in any wise the scales of gravity and attraction which had before been so nicely poised. It may indeed be said, that the two first mentioned are very insignificant worlds; one of them being (according to *White's Ephemeris*) 140 miles only in diameter, and the other about 200; so that upon a rough computation, from these dimensions, the smallest may be said to contain as much surface as Ireland, and the other about the same quantity as Great Britain. The whole quantity of matter contained in both, amounts to, probably, the five hundredth part of the bulk of the moon. Such petty worlds are a disgrace to the solar system!

upon the subject, such a boundless field for the fancy to exercise its freaks upon, but we shall have abundant room for all descriptive illustrations that are absolutely requisite, as well as for all calculations that are really useful.

Supposing the Newtonian system to be founded upon a true mathematical basis, and knowing that several learned men had professed to have reconciled its principles with those of the scriptures, I confess I formerly gave my assent to it, although my mind was staggered at its distances, magnitudes, and velocities; but having now examined for myself, and found it to be a baseless, though shewy and imposing fabric, I reject it, and exclusively adopt that system which is laid down in the first chapter of Genesis, and confirmed by every succeeding inspired writer;—a system which I am fully persuaded can never fail, because it evidently has its foundation in him who inhabiteth eternity.

B. PRESCOT.

*Etruria, 19th Nov. 1802.*



# THE ANONYMOUS CRITIC:

*Such of his remarks as I have thought it worth while to notice, are distinguished by inverted commas.*

Adverting to my statements of the distances and magnitudes, he observes,

	MILES:
" He" (that is, the author) " makes A (Fig. 1)	
distant from the sun, viz. line AS, .....	26,670
" I make A only, which is the real distance, .....	25,200
Difference .....	1,470
" He makes the earth's circumference .....	22,620
" But I, by multiplying 360° by 60, the geographical miles in a degree," (surprising!) " make it only ..	21,600
Difference .....	1,020
" He makes the sun's orbit .....	167,500
" His real orbit is only .....	151,200
Difference .....	16,300
" He makes the moon's distance from the earth's centre ..	15,210
" I make it only .....	14,400
Difference .....	810

I cannot conceive where this mathematician learned, that the circumference of a circle is no more than three times the diameter. According to Van Ceulen's quadrature of the circle, upon the principle of Archimedes, the proportion of the diameter to the circumference is as 1 to 3,14159, &c. therefore the circumference of the earth must be 26670 miles if the diameter be 7200, whether English or geographical. It is upon this principle that I have calculated the

distances of the sun and moon's centres from the centre of the earth ; also the diameters and circumferences of their orbits, and at present I see no reason to alter the statements I have given of those particulars : for although we may reasonably reject many extravagant theories of the mathematicians and astronomers, we are nevertheless obliged to them for all the useful truths that are handed down to us. The result of this reviewer's calculations would be exactly the same, however small or however large the globe might be ; that is to say, by multiplying the degrees of a great circle by the minutes in each ;

" Mr. Prescot, like the Newtonians, makes the earth's shadow " conical, terminating its vertex in a point about 5,000 miles beyond " the moon's orbit," (*not so much.*) " This they do because it is " necessary for their system, making the sun 111 times larger than " he really is," (*He must mean 990 times larger, that is to say, his diameter.*) " But such a shadow is both insufficient to answer a " central eclipse of the moon, or prevent Venus or Mercury from be- " ing also eclipsed by it." (*When did this critic see or hear of Venus and Mercury being in opposition to the sun ?*) " Mr. Prescot makes " the breadth of the shadow only about 1,800 miles" (*not 400 miles*) " on the moon's orbit, which she would pass through in little more " than half an hour," (*yes, if the shadow was stationary.*) " But we " know she is sometimes eclipsed by it for one, two, and three hours. " I have attempted to delineate the earth's shadow, making use of the " observed breadth of 12 degrees from each side of the moon's " descending node ; and though this shadow is nearly three times " broader than Mr. Prescot's, it may still be too narrow."

If this reviewer had considered the subject with any attention, he would never have given 24 degrees for the diameter of the lunar shadow ! for it never yet *appeared* of the breadth of *two* degrees. Why is the moon's *descending* node fixed upon ?

I am still of opinion that the moon's shadow is conical, or nearly so ; and, that the one I have delineated is quite sufficient to answer the appearance and duration of a lunar eclipse. However the opinions of men may differ as to the real magnitudes and distances, the *appear-*

ances are the same to all, and their contradictory theories cannot alter them; it is from the *appearances* that the particulars for the calculation of eclipses are obtained. Suppose, at the time of a lunar eclipse, the *apparent* diameter of the earth's shadow is  $87' 8''$ ; diameter of the moon  $33' 24''$ ; the hourly motion of the moon from the sun  $33' 22''$ ; then what would be the duration of a central eclipse. Add the diameter of the shadow to the diameter of the moon, and say, as  $33' 22''$  is to 1 hour, so is  $120' 32''$  to 3 hours 36 minutes, the total duration or thereabouts; it is sometimes more and sometimes less. From hence it may appear to this reviewer that it is not necessary for the shadow to be 24 degrees in breadth.

The apparent diameter of the earth's shadow, say  $87'$ , is equal to about 384 miles, at the distance of the moon's orbit; and  $33'$ , the apparent diameter of the moon, is equal to about 135 miles, at the same distance. But, this reviewer, (who, as well as myself, it seems, is a believer in the divine system) will object to this, by saying the diameter of the moon is 600 miles, and that therefore my statement must be wrong. The objection seems plausible, and, in reply, I can only say, that if properly examined, I believe what I have stated upon this matter will prove tolerably correct, *according to observation*. Why the moon appears no more than about one fourth as large as might be expected from her specific magnitude, I cannot pretend positively to say; but I conceive it must be owing to the medium through which she is viewed; this I apprehend would not be more wonderful than that other property of the same medium, which shews us the forms of the heavenly bodies, and confers upon us the benefit of their light, at the same moment that the earth completely interposes, and, otherwise, would really hide them from our sight. This is a fact that would not be believed were it not established by observation. It is asserted by Mr. Brothers, in his verification of the divine system, that "*there is no rule of optics however proper for earthly objects that can be applied with the least exactness to luminous bodies in the heavens, the vast expanse of air that lies between the earth and them sets all human efforts with the finest telescopes at defiance.*"

“ Mr. Prescot says the moon declines southerly about 14,100 miles, and northerly about 11,800. Now if this was true a person on the latitude of London would not upon the 21st of June see the full moon, no more than if he was 100 miles buried under ground.”—  
 “ The moon unquestionably as nearer the earth appears under a larger angle, but she does not appear to go out of the zodiac; and consequently from the *bare inspection* of the plan she can never decline such an enormous distance either way.”

This critic has given the matter a *bare inspection* indeed, otherwise his remarks would have been very different. I have nowhere stated that the moon declines northerly about 11,800 miles, and southerly about 14,100: I have calculated her greatest distance from London, when on the meridian at the moment of her greatest southern declination, at 14,182 miles; and her least distance 11,826 miles from London, when at her greatest northern declination. I have indeed said, that she declines about  $29^{\circ}$  from the equinoctial, and observation proves the truth of it. As to his observation, that “ she does not appear to go out of the zodiac,” it is very *indefinite*; I presume he will not assert, that she does not appear to go out of the ecliptic.

“ Mr. Prescot says the cause of pendulums vibrating *slower* here than at the equator is owing to the density of the air. If he had said heat, experience I believe would have proved his assertion; for heat surely expands iron, and cold contracts it.”

Surely the cold or some other cause must have contracted the senses of this writer whilst perusing the book; for, in the first place, I have not said, that pendulums vibrate *slower* here than at the equator, but the contrary; and, secondly, that it is owing to two causes, namely, the contraction of the metal, and the greater density of the air. At the equator the metal rod being lengthened by the greater heat, and the air being more rarified from the same cause, gives the pendulum a more extensive swing, which it is, of course, longer in performing.

He has made a long remark upon what I stated concerning the effect the comparatively small distance of the sun must have upon celestial observations, and particularly those made to ascertain the lati-

tudes; he concludes it by laying down, that " *All* lines relating to " the sphere must be drawn *spherical*, or be considered as such; and " *indeed* in the great northern latitudes if the sun's altitude was not " to be drawn cutting the sun's altitude in the quadrant by a *spherical line*, the inhabitants there could no more see the sun in the " winter solstice, or even *vernal* equinox, than if buried 100 miles " below ground!"

It appears that the creator never intended that the inhabitants of the most northerly parts of Iceland, Lapland or Greenland *should* see the sun in the winter solstice; and accordingly it is said they never do see him there, When in the equinoxes they might see him even without a *spherical* line as is evident from the right line FO, (*Fig. 1*) which is drawn from the sun touching the latitudes near the north pole.

It is not necessary to quote the first part of his remarks upon what I have written concerning the obliquity of the ecliptic; I leave the matter to judges of a different character for candour and intelligence; I shall only reply to his concluding lines upon that point. He observes " What the exact angle of the sun's northern declination at " Alexandria is, I cannot say, but if it was any thing like  $23^{\circ} 50'$ , " the scientific institute who went with Bonaparte to Egypt would " surely have long ere now made public such an important discovery." (Here he takes it for granted that they employed themselves upon this point.) " Yea the officers of the British and French *Navy* out " of curiosity, or to enlarge their sphere of useful knowledge, would " surely make accurate observations" (in moveable observatories!) " when the sun was in the summer solstice; and since their return " from Alexandria would, no doubt, if any thing like an increase of "  $32'$  ( $22'$ ) " had appeared, have been proud to announce it to the " world. Mr. Prescott may be *ambitious* to secure the palm of having solved the famous problem respecting the obliquity of the ecliptic in Ptolemy's time and the present; but upon reconsidering the " subject, and attending to *my remarks*, he may find himself deceived"

I do not think it probable that the scientific men who were engaged in the French expedition to Egypt, or the officers of either country, ever thought of examining the obliquity of the ecliptic while in Egypt. Such astronomical matters as they might be concerned in during their stay there would, I presume, be chiefly regulated by the Ephemerides or Nautical Almanacks which are annually published in Europe; and, as such tables are constructed according to the hypotheses of the solar system, it would be absurd to suppose it could enter their minds to examine an angle, which, according to the distance at which that system places the sun, could not be sensibly affected by the difference in the latitudes of London, or Paris, and Alexandria. I confess to this critic that I see no harm in attempting to solve the point in question; if the zeal which impels me to offer my testimony be *ambition*, as he chooses to term it, it is perfectly innocent, as no one is either injured or oppressed by it.



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1. The first part of the document is a letter from the President of the United States to the Congress, dated January 1, 1861. It is a very important document, as it sets out the policy of the new administration. The President, James Buchanan, states that he is a peace man, and that he will not allow the country to be divided by the issue of slavery. He also states that he will not allow the federal government to interfere with the rights of the states. This letter is a key document in the history of the United States, as it shows the President's stance on the issue of slavery and the rights of the states.











